

The Evaluation of Automated Systems

A Monograph

by

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The end of the 20th Century presented the United States Army a new technological and geopolitical environment. The Army has recognized this change and is adapting to operate in this new environment. The army has developed a number of new automated tools to assist leaders to command and control their organizations. One tool currently being developed, tested, and integrated into the Army is the Combined Arms Planning and Execution Monitoring System or CAPES. CAPES is designed to assist decision makers develop, coordinate, and produce operational plans. As this and other automation systems are developed, they must be evaluated. This monograph focuses on the evaluation process. Investigating the process identified a number of problems an evaluation might encounter during the assessment. Assessors can now use this list to design aspects of future evaluations. Initially the research for this monograph attempted to evaluate the usefulness of CAPES. To determine whether CAPES was useful a test was organized to compare two planning efforts. Two military staffs planned operations based on a similar problem. The experiment defined one planning staff, using traditional planning tools, as the bases of comparison. The second group would have the benefit of CAPES. The early collection and analysis of observations from the two planning groups indicated the design of the experiment was inadequate to show either CAPES' benefits or faults. Initial scrutiny revealed significant problems with the experiment's design. Investigation of the difficulties discovered problems in the scenario selected, organization of the planning staff, and the exercise architecture. Analysis of the problems indicated greater attention must be placed on selecting scenarios that replicate command and control conditions intended for CAPES. The staff used in the experiment not only requires adequate training with the planning tools available, they also need sufficient practice working together as a staff. Command and control systems must interconnect and communicate across all Battlefield Automation Systems (BAS) and staffs must use all of the subsystems simultaneously. The problems identified during this study constitute a set of preventable deficiencies where system designers and evaluators can avoid when conducting software assessments. Incorporating the overlooked design parameters with those of the planned test will lead to a better assessment of automation planning tools during future research.

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The end of the 20th Century presented the United States Army a new technological and geopolitical environment. The Army has recognized this change and is adapting to operate in this new environment. The army has developed a number of new automated tools to assist leaders to command and control their organizations. One tool currently being developed, tested, and integrated into the Army is the Combined Arms Planning and Execution Monitoring System or CAPES. CAPES is designed to assist decision makers develop, coordinate, and produce operational plans. As this and other automation systems are developed, they must be evaluated. The Army uses evaluation to determine the merits of a system. The evaluation also reveals deficiencies a system must correct to become more useful.

This monograph focuses on the evaluation process. Investigating the process identified a number of problems an evaluation might encounter during the assessment. These problems identified in the research for this paper are now documented. Assessors can now use this list to design aspects of future evaluations.

Initially the research for this monograph attempted to evaluate the usefulness of CAPES. To determine whether CAPES was useful a test was organized to compare two planning efforts. Two military staffs planned operations based on a similar problem. The experiment defined one planning staff, using traditional planning tools, as the bases of comparison. The second group would have the benefit of CAPES. The early collection and analysis of observations from the two planning groups indicated the design of the experiment was inadequate to show either CAPES' benefits or faults. Initial scrutiny revealed significant problems with the experiment's design. These problems prevented any comparison of the two planning efforts. Investigation of the difficulties discovered problems in the scenario selected, organization of the planning staff, and the exercise architecture.

Analysis of the problems indicated greater attention must be placed on selecting scenarios that replicate command and control conditions intended for CAPES. The staff used in the experiment not only requires adequate training with the planning tools available, they also need sufficient practice working together as a staff. Command and control systems must interconnect and communicate across all Battlefield Automation Systems (BAS) and staffs must use all of the subsystems simultaneously. The problems identified during this study constitute a set of preventable deficiencies where system designers and evaluators can avoid when conducting software assessments. Incorporating the overlooked design parameters with those of the planned test will lead to a better assessment of automation planning tools during future research. Creating planning staffs from students enrolled in military schools initially appeared attractive; however, the students neither have the required training on new information systems nor the time to develop the organizational relationships required in an established functioning staff.

TABLE OF CONTENTS

INTRODUCTION	2
DIGITAL INFORMATION SYSTEMS	6
Army Battle Command System	6
CAPES: Maneuver Planning tool of ABCS	9
COMMAND AND CONTROL	11
Command and Control Information	12
Decision-making	16
COMPARISON OF PLANNING EFFORTS	19
Historical Middle East Conflict	21
Golan Heights – 1973	25
The Practical Exercise	30
Staff Organization	31
Planning Tools	32
Training	34
OBSERVATIONS	36
CONCLUSIONS AND RECOMMENDATIONS	38
Scenario Selection	39
Staff Training	42
Collaboration	44
ANNEX A	47
Global Command and Control System–Army (GCCS – A)	47
Maneuver Control System (MCS)	47
Force XXI Battle Command Brigade and Below (FBCB2)	49
Combat Service Support Control System (CSSCS)	49
Advanced Field Artillery Tactical Data System (AFATADS)	50
Air and Missile Defense Planning and Control System (AMDPCS)	51
Tactical Airspace Integration System (TAIS)	52
All Source Analysis System (ASAS)	53
Integrated Meteorological System (IMETS)	54
Digital Topographic Support System (DTSS)	55
Integrated System Control (ISYSCON)	55
BIBLIOGRAPHY	56

INTRODUCTION

The end of the 20th Century introduced the United States to a new set of strategic challenges. The comprehensive global cold war had ended. The primary historic danger to democracy dissolved with the fall of the Berlin Wall and the fragmentation of the Soviet Union's republics.¹ The United States of America found itself without a cohesive threat for the first time in almost fifty years. The U.S. Army was no better prepared for this new environment than the rest of America. Without an immediate credible enemy, the Army found it difficult to focus on a clear objective.² The U.S. military no longer needed to think of equipping, training, and planning a strategy to counter a Soviet invasion in central Europe.³ The United States was in a position, for the first time in over half a century, to look forward and posture itself for the emerging threats of the future. Threats not clearly defined or totally understood by anyone. This new and vague adversary made building a comprehensive roadmap for the modernization of a future U.S. Army exceptionally difficult.

In late 1994, the United States Army Training and Doctrine Command (TRADOC) attempted to provide the focus needed by the Army to prepare for its future. In August of that year, it published TRADOC Pamphlet 525-5, *Force XXI Operations*, to provide guidelines for developing the structure and organization of the Army as it entered the 21st Century. Military officers designated the U.S. Army of the next century "Force XXI."⁴ TRADOC Pam 525-5 provided guidance and direction to the Army's force development leadership as they designed a campaign plan that would generate the Army's future force. The newly published guidance

¹ "Cold War Timeline." Internet: www.fas.org/man/dod-101/ops/docs/coldwar_timeline.htm. Accessed 27 January 2004 and "The End of the Cold War." Internet: <http://americanhistory.si.edu/subs/history/timeline/end/index.html>. Accessed 27 January 2004.

² Department of the Army. *TRADOC Pamphlet 525-5. FORCE XXI OPERATIONS: A Concept for the Evolution of Full-Dimensional Operations for the Strategic Army of the Early Twenty-First Century*. (Washington D.C.: U.S. Government Printing Office, 1 August 1994), 1-1.

³ Department of the Army, *FM I, The Army*. (Washington D.C.: U.S. Government Printing Office, 14 June 2001), 15.

described the conceptual foundations for Army operations in 21st Century.⁵ The pamphlet identified five attributes of the future battlefield. These attributes were battle command, extended battlespace, simultaneity, spectrum supremacy, and the rules of war. The doctrine writers identified one present-day battlefield characteristic that both dominated the past and will endure in the future, battle command.⁶

While TRADOC Pam 525-5 maintains that battle command would remain one of the key aspects of the future battlefield, it also identified a number of significant changes that would take place in the global environment. TRADOC projected a significant increase in worldwide technology and speculated that technology would have significant impact on the future battlefield.⁷ Beginning in the 1970s, advances in computer technology increased civilization's ability to acquire, manipulate, and publish information.⁸ The growth of available information has revolutionized how organizations, nations, and people interact. The development of more advanced information technology has increased the interaction between world communities. Projections show that information technology will advance a thousandfold in the next 20 years.⁹

The average American citizen eagerly embraces automation. The public can now quickly access larger quantities of information more quickly than ever before. New technology advances have reduced system costs and increase user-friendliness of information processing and sharing tools. The U.S. Army, like the government and people it serves, has become more comfortable with computers and has increased its use in garrison and field operations. New automated information systems have changed how the Army collects, processes, and transmits information

⁴ John R. Brooks and Steven L. Campbell, "The EXFOR, Intelligence in Force XXI." *Military Intelligence Professional Bulletin*, 1996, Internet: <http://www.fas.org/irp/agency/army/tradoc/usaic/mipb/1996-2/brks-cam/htm>. Accessed 27 January 2003.

⁵ Ibid., *TRADOC Pamphlet 525-5*, i.

⁶ Ibid., 2-8.

⁷ Ibid., 1-5.

⁸ *The American Heritage® Dictionary*, 4th ed., s.v. "information age". Houghton Mifflin Company. Internet: <http://dictionary.reference.com/search?q=information%20age>. Accessed 31 March 2004.

⁹ Ibid., *TRADOC Pamphlet 525-5*, 1-5.

during daily operations. The Army has begun to incorporate information systems into both its doctrine and equipment development plans. These changes are modifying the way staffs and commanders formulate and make decisions during daily operations.

In the last decade, the Army has invested in programs that specifically target organizational areas where battle command and information technology merge. That application of resources supported TRADOC's guidance and remained consistent with predications of technological advancements. Starting in 1994, the U.S. Army invested \$20 billion over nine years in programs to create and improve the Army Battle Command System (ABCS).¹⁰ ABCS provides the Army information age technology for command and control of its forces.¹¹ The concept for the future of battle command empowers the Army's soldiers to make better decisions using information technology. The Combined Arms Planning and Execution Monitoring System (CAPES) is an element of the ABCS software program designed to facilitate planning and decision-making.¹² CAPES is one program that attempts to benefit from the rewards exposed when systems developed around information age technology are used to support military organizations with battle command.

The US Army has already sunk a great amount of resources into the development of the ABCS and CAPES. Because Army resources are limited, it must focus its available assets on the technology that proves to be most useful. If these new systems do not clearly facilitate and improve the military planning process, the Army should and will apportion its limited resources to a more fruitful planning system. Only the usefulness of a system can justify the additional commitment of development time and money.

¹⁰ Frank Tiboni, "Army plans spring deployment of ABCS." *Federal Computer Week*, Internet: <http://www.fcw.com/fcw/articles/2003/1222/web-abcs-12-24-03.asp>. Accessed 25 April 2004.

¹¹ Ibid., *TRADOC Pamphlet 525-5*, 3-4.

¹² Department of the Army, *CAPES: The Combined Arms Planning and Execution Monitoring System. Reference Manual, Release 3.1*. (Washington D.C.: U.S. Government Printing Office, July 2003), 2-1.

This monograph's research originally sought to determine the utility of CAPES as a planning tool. Specifically, the intention was to determine whether CAPES significantly improved planning and decision-making. Capes is designed as a "next generation command and control system" that assists commanders and staffs with operational planning.¹³ Planning is defined as how a "commander envisions a desired outcome, lays out effective ways of achieving it, and communicates to his subordinated his vision, intent and decisions."¹⁴ U.S. Army Doctrine defines command and control systems in FM 6-0, *Mission Command: Command and Control of Army Forces*. To be successful CAPES must achieve the objectives defined in this doctrine. It also must achieve these as well as, or better than, other systems currently in use.

To determine whether CAPES was useful a test was organized to compare two planning efforts. Two staffs would conduct a military planning process based on a similar problem. The experiment defined one planning staff, using traditional planning tools, as the bases of comparison. The second group would have the benefit of CAPES. The early collection and analysis of observations from the two planning groups indicated the design of the experiment was inadequate to show either CAPES' benefits or faults. Initial scrutiny revealed significant problems with the experiment design. These problems prevented any comparison of the two planning efforts. Investigation of the difficulties discovered problems in the scenario, planning staffs, and infrastructure environment.

Analysis of the problems indicated greater attention must be placed on selecting scenarios that replicate command and control conditions intended for CAPES. The staff used in the experiment not only requires adequate training with the planning tools available, they also need sufficient practice working together as a staff. Command and control systems must interconnect and communicate across all Battlefield Automation Systems (BAS) and staffs must use all of the

¹³ Ibid.

¹⁴ Department of the Army, *FM 3-0, Operations*. (Washington D.C.: U.S. Government Printing Office, 14 June 2001), 6-1.

subsystems simultaneously. The problems identified during this study constitute a set of preventable deficiencies for system designers and evaluators to avoid when conducting software assessments. Incorporating the overlooked design parameters with those of the planned test will lead to a better assessment of automation planning tools during future research.

DIGITAL INFORMATION SYSTEMS

The U.S. Army has increased the use of automation as computers have developed and improved. Information age technology simplifies complex tasks and reduces the need for human interaction during uncomplicated repetitive activities.¹⁵ This allowed leaders to focus human resources on intangible, ill-defined problems. The Army initially used automated systems independently, rarely developing a habitual link to other equipment. The Army leadership, in the early 1990s, attempted to harness information sharing capabilities. The Army Battle Command System concept attempted to create a collaborative system that routinely and quickly shared information. This new concept integrated information from all the Battlefield Functional Areas (BFA). The combined power of this information develops knowledge greater than its individual parts.

Army Battle Command System

ABCS is not a single system¹⁶. The instructional manual for ABCS labels it as a “System of Systems” as opposed to one defining piece of equipment.¹⁷ The new command and control system does not have a lone separate contract and, therefore, is better defined as an “entity” rather

¹⁵ Ibid., *CAPEs: Reference Manual, Release 3.1*, 2-1.

¹⁶ Department of the Army, *Weapon systems 2001*, (Washington D.C.: U.S. Government Printing Office, 2001.) Internet: <http://www.defensedaily.com/progprof/army/abcs.pdf>. Accessed 9 April 2004, 21.

¹⁷ Department of the Army, *ABCS: Army Battle Command System Leader's Reference Guide, Version 6.2*. (Washington D.C.: U.S. Government Printing Office, 12 February 2002), 1-3.

than a single program.¹⁸ Designers fused together a number of separate systems to create a suite of applications to assist commanders as they gather, process and track information. The ABCS “entity” incorporates more than a hundred separate programs that address all the battlefield functional areas.¹⁹ Each major subsystem of ABCS, the Battlefield Automation Systems, developed tools specifically focused to contribute to its supported Battlefield Operating System (BOS). Most of these automation systems include planning tools to help create, analyze, and document different Courses of Action (COAs) by placing emphasis on individual BOS related tasks. However, ABCS is more about collaboration between the systems than how an individual system works. ABCS allows commanders and staffs to reach across every Battlefield Operating System to request, select, and evaluate data from diverse resources creating a synergistic effect. This synergy yields an entire and more complete knowledge base greater than the sum of its individual parts. Each Battlefield Automation System is able to contribute and help provide a Common Operating Picture (COP). This operating picture in turn helps give the commander situational understanding and helps answer the following six questions:²⁰

- Where am I?
- What is my status?
- Where are the other friendly units?
- What is their status?
- Where is the enemy?
- What is the enemy’s status?

The answers to these questions assist a commander properly command and control his organization. They provide the commanders with the key information about friendly units, enemy units, and the environment in which they must operate. This information helps the

¹⁸ Ed McKenna, “Agency Profile: Army: Army Modernizes as It Digitizes.” *Washington Technology*. Internet: http://www.washingtontechnology.com/news/15_6/tech_features/1474-1.html. Accessed 1 April 2004.

¹⁹ Ibid.

²⁰ Ibid., *ABCS v6.2 Leader's Reference Guide*, 1-3.

commander better arrange resources on the battlefield to accomplish the mission assigned to his organization.

ABCS is the army's component to the Global Command and Control System (GCCS).²¹ A Joint Common Database (JCDB) fuses the individual battlefield automation system together within ABCS to provide the commander with timely and accurate information about the situation surrounding the operation. The system provides the commander situational understanding by creating a clear operational picture. ABCS is comprised of the following eleven major subsystems:²²

- **Global Command and Control System–Army (GCCS-A)** provides an integrated and automated Information Systems (INFOSYS) for Army strategic and theater commanders, corps commanders, and division commanders serving as joint task force commanders or Army service component commanders (ASCCs).
- **Maneuver Control System (MCS)** is the primary tactical-level INFOSYS. It provides the common operation picture; decision aids, and overlay capabilities through interface with other ABCS systems.
- **Force XXI Battle Command Brigade and Below (FBCB2)** provides integrated, on the move, and timely relevant information (RI) to tactical combat, combat support (CS), and combat service support (CSS) leaders and soldiers.
- **Combat Service Support Control System (CSSCS)** replaced by **Battle Command Service Supply Support (BCS3)** provides quality automated CSS information (including all classes of supply, field services, maintenance, medical, personnel, and movements) to combat, CS, and CSS commanders; their logistic and special staffs; and to the ASCC.
- **Advanced Field Artillery Tactical Data System (AFATADS)** is a fully integrated fire support INFOSYS. It gives the fire support coordinator automated support for planning, coordinating, controlling, and executing close support, counter, interdiction, and suppression-of enemy-air-defenses fires.
- **Air and Missile Defense Planning and Control System (AMDPCS)** integrates air defense fire units, sensors and C2 centers into a single system capable of defeating/denying aerial threats (including unmanned aerial vehicles, helicopters, fixed-wing aircraft, and other platforms). AMDPCS includes AMDWS (the air and missile defense workstation).
- **Tactical Airspace Integration System (TAIS)** is the Army's enabling system for digitization, integration, and automation of Army airspace command and control planning and operations, and for air traffic services.

²¹ Ibid., 2-1.

²² Department of the Army, *FM 6-0, Mission Command: Command and Control of Army Forces*. (Washington D.C.: U.S. Government Printing Office, 11 August July 2003), 5-13.

- **All Source Analysis System (ASAS)** consists of evolutionary modules that perform system operations management, system security, collection management, intelligence processing and reporting, high-value/high-payoff target processing and nominations, and communications processing and interfacing.
- **Integrated System Control (ISYSCON)** provides integrated technical system control for the integrated ABCS systems.
- **Integrated Meteorological System (IMETS)** provides general weather forecasting, severe weather warnings, and weather effects analysis.
- **Digital Topographic Support System (DTSS)** provides tactical and operational commanders with geospatial information to support terrain and environment parts of commander's visualization.

Annex A provides a more detailed explanation of each ABCS component.²³ Each of the Battlefield Automation Systems focuses on a specific functional area. ABCS fuses the information that each system provides. The combined information ABCS provides commanders and staffs assists them as they make decisions during the planning and execution of an operation.

CAPES: Maneuver Planning tool of ABCS

One initiative the U.S. Army intends to integrate into ABCS is the Combined Arms Planning and Execution Monitoring System (CAPES).²⁴ CAPES is one of many tool the US Army is testing to enhance battle command in the information age. Developers of ABCS plan to incorporate CAPES into future versions of Maneuver Control System (MCS).²⁵ Many units have already begun to use beta test versions of the software for warfighting experiments, training, and combat operations.²⁶ The 4th Infantry Division deployed a CAPES proficient staff with contract

²³ Ibid., *ABCS v6.2 Leader's Reference Guide*, Chapter 2 and Ibid., FM 6-0, 5-13. Annex A combines information provided in these two sources.

²⁴ Chau, Ka-Ki. "Providing Command and Control Tools to the Warfighter and Homeland Security Applications." CERDEC, C2D. Fort Monmouth, NJ. Presented to 2004 Command and Control Research and Technology Symposium. Internet: http://www.dodccrp.org/events/2004/CCRTS_San_Diego/abstracts/226.pdf. Accessed 24 March 2004.

²⁵ Ibid.

²⁶ *The American Heritage® Dictionary*, 4th ed., s.v. "beta test". Houghton Mifflin Company. Internet: <http://dictionary.reference.com/search?q=beta%20test>. Accessed 31 March 2004. A beta test is a field test of a prototype version conducted prior to commercial release.

support during Operation Iraqi Freedom (OIF).²⁷ CAPES is currently being used across the U.S. Army at Corp and Division level headquarters such as III Corps, XVIII Airborne Corps, the 4th Infantry Division and US Forces Korea.²⁸

CAPES uses a collection of decision aid software tools to enable mission focused planning. This technology package was named, Distributed Analysis and Visualization Infrastructure for C4I, Da Vinci. Viecore Federal Systems Division developed the new technology. Viecore's goal is to let the software package focus on the details of battle and allow commanders and staffs to focus on the higher-level concepts.²⁹ Originally, Viecore developed the Da Vinci technology as a self-contained application that interacts directly with MCS. The first effort, called Battlefield Planning and Visualization (BPV), was Unix based and did not interact well with other ABCS programs.³⁰ Viecore switched computer operation systems to a windows based platform to improve BPV's interoperability after tests as the Division Capstone Exercise (DCX). The Da Vinci technology using the new operating system was called CAPES. The CAPES Reference Manual highlights the following capabilities the system provides to assist in command and control:³¹

- **Graphical and animation capabilities:** CAPES allows you to define tasks and see the effect of those tasks over a period of time. Animation features allow you to replay tasks in many different ways.
- **Interface capabilities:** CAPES allows you to import various databases to assist in planning.
- **Collaboration:** CAPES allows you to share plans with other systems in a military operation.

²⁷ Ibid., "Providing Command and Control Tools to the Warfighter and Homeland Security Applications". Mr. James Rodgers deployed with 4ID to Operation Iraqi Freedom (OIF) to provide CAPES contract support. Mr. Rodgers is an employee of Viecore.

²⁸ Edward Dawidowicz, "The Right Information... and Intelligent Nodes." Presented to 8th International Command and Control Research and Technology Symposium. Internet: <http://philsci-archive.pitt.edu/archive/00001282/01/105.pdf>. Accessed 15 April 2004.

²⁹ Ibid., "Providing Command and Control Tools to the Warfighter and Homeland Security Applications".

³⁰ Department of the Army. *Army Battle Command System (ABCS) Version 6.2 Smart Book*. (Fort Hood, TX. Created locally by Warrior-T for DCX Phase I. January 2001), 14.

³¹ Ibid., *CAPES: Reference Manual, Release 3.1*, 2-1.

- **Time-saving organizational capabilities:** CAPES allows you to define multiple courses of action, each with a separate user-defined name and set of properties. This provides a framework that supports command and control planning. After you define them, you can reuse any task organizations or plans in multiple scenarios, decreasing the amount of time required for “what-if” analyses.
- **Graphics:** Display graphical control measures from either a database, a graphics file, or another mission.

These capabilities assist the commander understand the environment, friendly forces, and the enemy as he conducts operations. How a commander understands the situation is key to his ability to command and control. Superior knowledge assists commanders envisage the situation, make decisions, and directs organizations. It is essential for effective command and control and eventually mission accomplishment.

COMMAND AND CONTROL

U.S. Army doctrine defines command and control in FM 6-0 as the “exercise of authority and direction by a properly designated commander over assigned and attached forces in the accomplishment of a mission.”³² A single commander cannot command and control a complex organization alone. Commanders require support to exercise effective command and control even for relatively small units. Command and control systems support commanders as they direct control and coordinate their larger and more complex forces.³³ Commanders, however, remain the key to command and control.³⁴ One way the Army is attempting to enhance a commander’s ability to practice the art of command is by improving the command and control system that supports the commander. Specifically the Army is focusing on how to create more advantageous information systems.³⁵ Information systems manage and process information to assist commanders as they make decisions. The following chapter investigates the structure of command and control systems, what information it provides the commander, and how that information assists the commander.

³² Ibid., *FM 6*, 1-1.

³³ Ibid., 1-4.

Command and Control Information

Command and control is essential to the successful conduct of warfare. The U.S. Army understands the importance of command and control and continues to create tools and procedures to help leaders command and control their organizations.³⁶ These tools increase the lethality of the force and enhance force protection.³⁷ To understand how these tools improve the force a brief examination of command and control is required.

The commander is ultimately responsible for the conduct of his organization. However, only at the lowest and simplest levels is a leader able to maintain command and control without some kind of supporting system. Typically, the elements that make up command and control of an organization are the commander and the command and control system that supports them.³⁸ While commanders focus primarily on the art of command, the supporting system concentrates on the science. Using his command and control systems a commander “initiates and integrates” the resources at his disposal to accomplish a common objective.³⁹

The command and control system supports a commander. It focuses on the science of command and control allowing the commander more time to concentrate on the art. The command and control system is comprised of four sub-elements: personnel, information management, procedures, and equipment. No single element of the system can provide support to the commander alone. Each element is interrelated, relying on all of the others to collectively provide support the commander. Figure 1 shows the general structure of command and control.

³⁴ Ibid., 4-1.

³⁵ Ibid., 1-19.

³⁶ Ibid., xiv.

³⁷ Ibid., *ABCS v6.2 Leader's Reference Guide*, 1-1.

³⁸ Ibid., *FM 6*, 1-5.

³⁹ Department of the Army, *FM 3, Operations*. (Washington D.C.: U.S. Government Printing Office, 14 June 2001), 5-17.

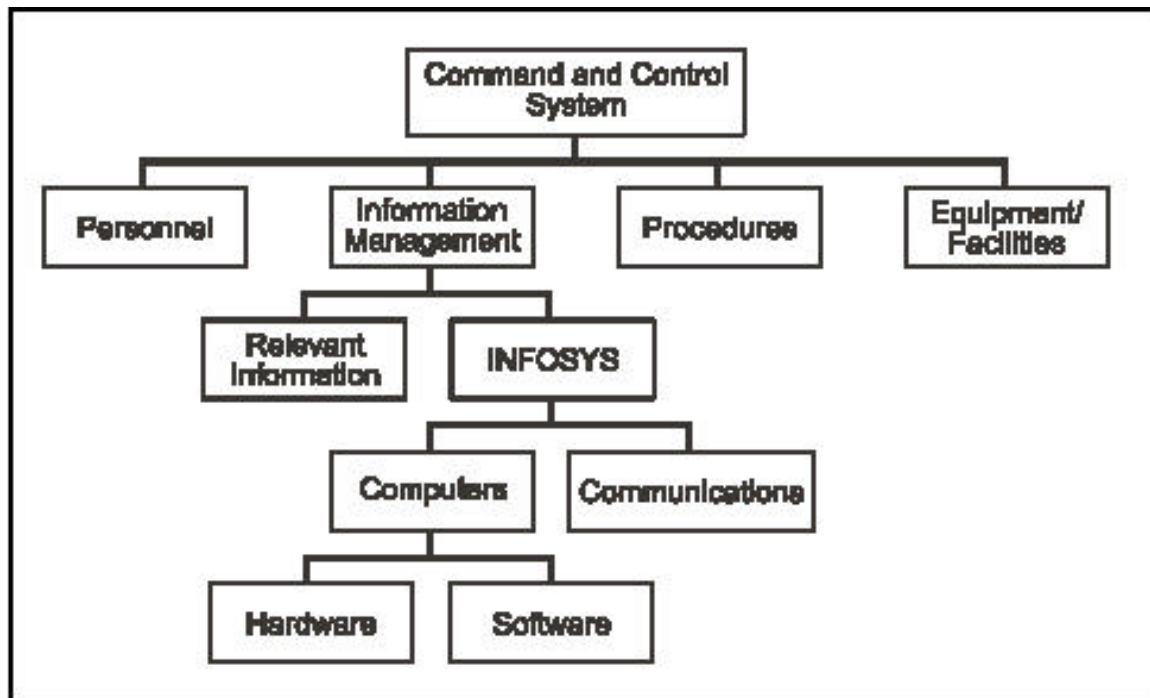


FIGURE 1 – ELEMENTS OF THE C2 SYSTEM⁴⁰

The command and control system supports the commander by performing three major functions. It creates and maintains the common operating picture for the organization. The command and control system supports decision-making at all levels by improving speed and accuracy. Finally, it supports the preparation and communication of execution information to subordinate, adjacent and higher headquarters.⁴¹ These three functions allow the commander to make informed decisions, delegate authority, and coordinate the resources available to his command to ultimately accomplish the organization's ultimate objective of mission accomplishment.⁴²

One of the four interrelated elements that make up the command and control system is information management. FM 3-0, *Operations*, defines information management as “the provision of relevant information to the right person at the right time in a usable form to facilitate

⁴⁰ Ibid., FM 6, 5-2.

⁴¹ Ibid.

⁴² Ibid., FM 3, 5-17.

situation understanding and decision making.”⁴³ Information management provides a commander with relative information to improve his situational awareness and assist in decision-making. Information management, however, must do more than just move information along the hierarchical or networked communications grid. It must separate, process, and synthesis information from all the available sources to add significance and help decision makers gain understanding. Information management consists of two supporting components: information systems and relevant information. Both components are associated with information. The first is the different operations conducted on the information. The second is the actual information.

The first component of information management is the information system. This system performs actions on the information. Information systems have five activities or characteristics. These activities are collection, processing, display, storage, and dissemination. Figure 2 shows how the activities of an information system interact with other information systems. As the information systems from different headquarters interact, they create a linked network of command and control systems. These headquarters are subordinate, adjacent, and higher each providing and requesting information.

Information systems must do more than collect and disseminate information. They must process and display information. Information systems fuse information and represent it clearly to a commander to minimize the time it takes to digest and understand the impact of the information on the situation. Properly analyzed and plainly displayed information assist the commander as they develop their situational understanding.

⁴³ Ibid., 11-11.

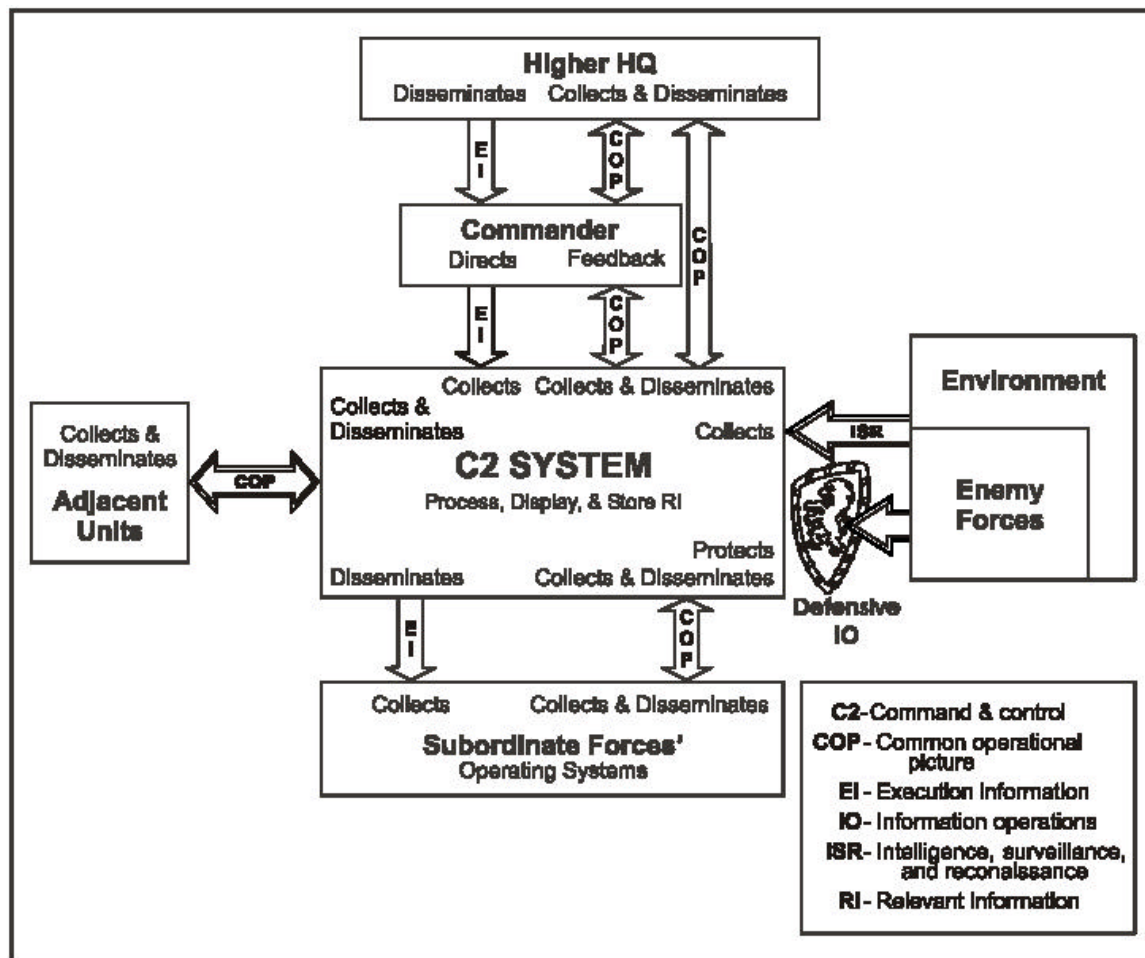


FIGURE 2 – Information System Interactions ⁴⁴

The second component of information management is the information that the information system manages. Information management does more than just move information. The system determines the value of the information as it process facts, statistics, and data. It determines what information qualifies as important or useful. A properly running information system is able to get the right information to the right person at the right time. When information is accurate, timely, useable, complete, precise, and reliable it is relevant.⁴⁵ Relevant Information (RI) creates and maintains the common operating picture and helps the commander develop an understanding of the environment and situation in which his organization must operate. The facts

⁴⁴ Ibid., *FM 6*, 5-3.

⁴⁵ Ibid., 3-11.

and analysis that information management provides is key to the commander's understanding of the environment and facilitates the commander's decisions. Managing information properly narrows the discrepancy between the relative information a commander needs and the information currently available to him. Relevant Information is the information a commander uses to develop situational understanding and make decisions.

Decision-making

One of the elements of command is decision making. Decision-making is selecting the most favorable course of action to accomplish the mission. Compared to the other elements of command that rely more on the science of command, decision-making largely involves the art of command.⁴⁶ This does not mean that decision-making does not involve any science.

Commanders make decisions based on how they perceive the battlefield. The supply of relevant information to the commanders is how the science of command influences the decision-making process. Understanding how commanders personally contribute to the decision-making process helps illustrate this.

Commanders influence the decision making process by using the *visualize-describe-direct* methodology. A commander's visualization focuses on three questions:⁴⁷

- Where do I want to be or the end state?
- What is the situation now?
- How can I get there?

The way a commander perceives or visualizes the battlefield helps him answer these questions. A key component to the visualization process is the commander's understanding of the situation in which his organization must operate.

⁴⁶ Ibid., 2-14.

⁴⁷ Ibid., 2-16.

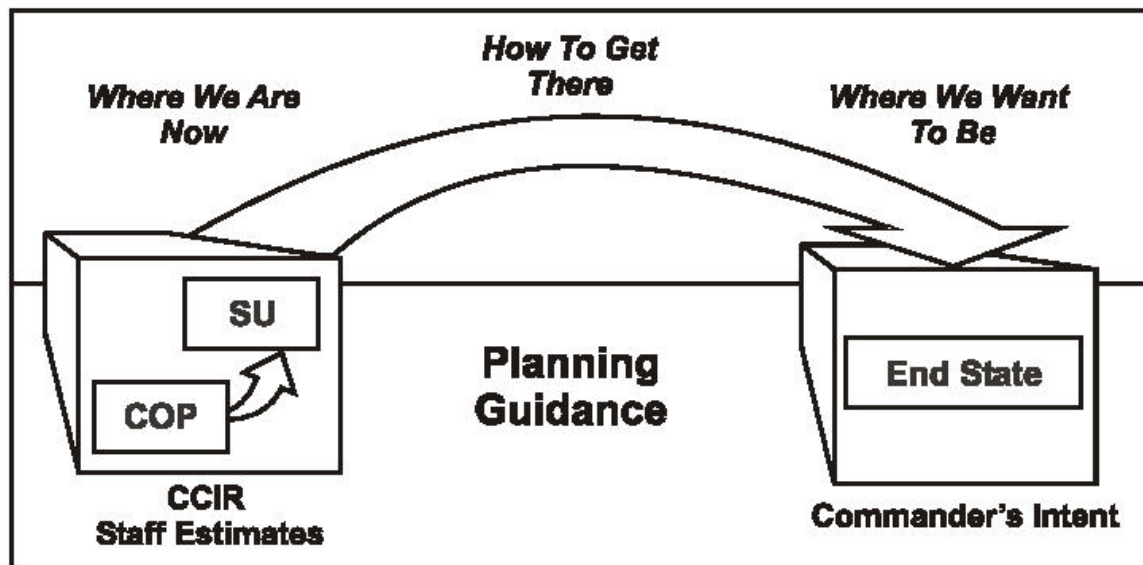


FIGURE 3 – Commanders Visualization⁴⁸

Situational understanding is a mixture of art and science. It is the way a commander understands the state of friendly forces, enemy forces, and environment in which both must operate. A number of things influence how a commander creates the mental image that is his vision of the battlefield.⁴⁹

- Military doctrine and training
- Personal experiences
- Forced goals from higher commands or internal to the command
- Decisions
- Relevant information

A commander combines all these contributions to help shape his opinion of reality. Each influence is weighted or given some value of importance based on the commander's judgment. The commander would like to increase the certainty of his vision of the battlefield by relying more on science than art. This, however, is not always the case. The art of command has a large influence on how a commander develops his situational understanding.

⁴⁸ Ibid., 2-16.

⁴⁹ Ibid., 2-14 and 4-2. Personal experiences must include military schools, doctrine and training. It also includes cultural background experiences encounter throughout the entire life of the officer.

Situational understanding has its largest impact on how the commander visualizes the current situation. It also can influence how he looks forward to the end state and how he chooses the method of achieving his goal. For example, how the commander understands the terrain and its effect on his organization influences the commander's planning guidance. Knowing how the enemy is arrayed on the objective could significantly change the commander's chosen end state. Figure 3 is misleading when it implies that situational understanding is a function only of the current situation. A commander's situational understanding clearly influences the other aspects of his visualization. FM 6-0 discusses how situational understanding influence both the development of key tasks and the commander's end state.⁵⁰

In a perfect world, a commander has all the information needed to understand all the aspects of the situation. Perfect relevant information brings more science into the commanders understanding. In reality, this is often not the case. Much of the information needed by the commander is absent. To make up for this a commander replaces analyzed information with intuition and assumptions.⁵¹ Figure 3 shows how the art and science of command and control change as time progresses. As time advances, staffs confirm the accuracy of information and analyze the information's impact on the operation. Information based on analysis and more certainty of fact replaces assumptions base information created by a commander's intuition. The solid line shows the traditional balance of art and science over time. Digital systems increase complexity of C2 systems but give commanders more timely and relevant information.⁵² The dashed line shows how situational understanding changes as command and control systems provide commanders with greater quantities of relevant information. This increase in the amount science and relevant information does not mean that commanders need intuition or the art of

⁵⁰ Ibid., 2-16 to 2-18.

⁵¹ Ibid., 4-2.

⁵² Ibid., 1-6.

command any less. The commander can now focus the efforts of his intuition on more complex tasks. Routine and undemanding tasks are completed by the information system.

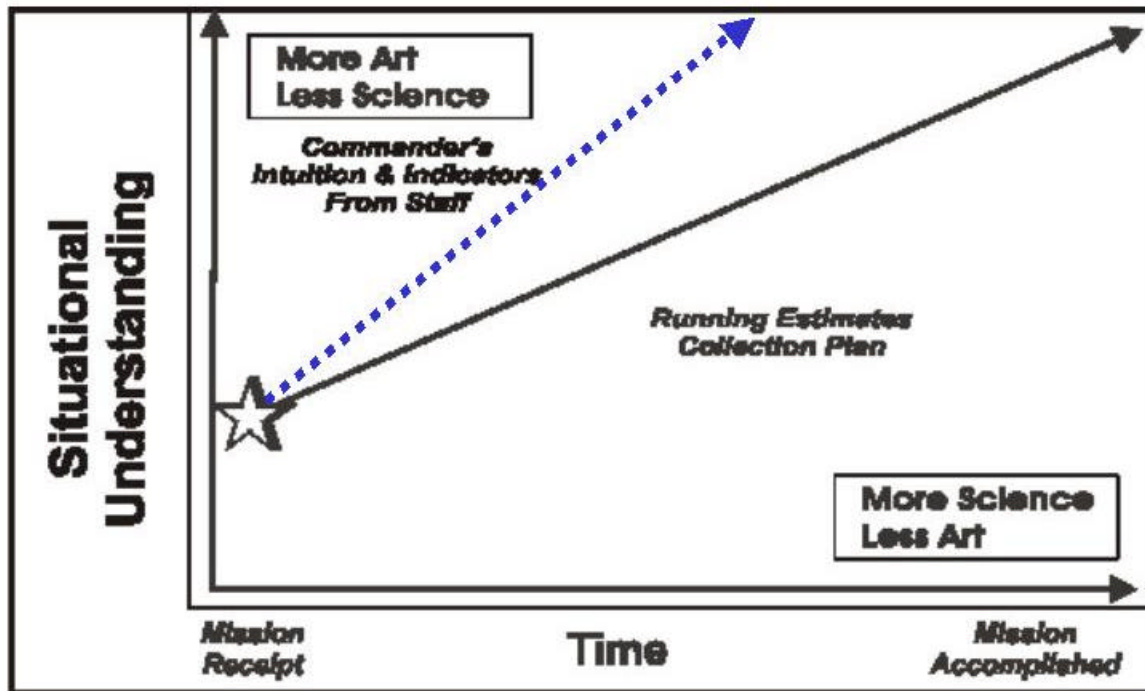


FIGURE 3 – Science and Art⁵³

COMPARISON OF PLANNING EFFORTS

Command and control is nothing new to the U.S. Army. The introduction of automated planning tools, however, is relatively new concept. Determining the value of a new system requires an assessment. Conducting a comparison is one way to assess an automated tool and determine if it helps commanders and staffs conduct planning. This monograph examined two similar planning processes to establish if CAPES significantly contributed to a staff's planning effort.

⁵³ Ibid., 4-4.

Observing the two different planning efforts allows assessors to determine the merits of CAPES. CAPES is designed to be an automated information system. Information systems are the tools and equipment used to handle information. Information systems collect, process, store, display, and disseminate information. An information system's value is measured by its ability to conduct these five activities. The advantages of CAPES as an information system can be shown if it can accomplish any one of these activities better than the currently used systems.

The comparison needed two military staffs planning similar scenarios. The first staff used traditional tools to conduct planning for the operation. The second group used an automated planning tool, CAPES, to assist in their planning effort. The School of Advanced Military Studies (SAMS) conducts a number of planning exercises during the year as part of its curriculum. CAPES is one tool provided to the student staffs as they practiced developing military plans. In December 2003, SAMS conducted a planning exercise focused on the 1973 Arab-Israeli Yom Kippur War. Accessibility to the exercise made it a logical choice for a planning group using CAPES. However, a similar group not using CAPES during the exercise was not available. Each staff planned a different perspective of the battle and all of the student staffs attempted to use automated tools to assist in the planning effort. The absence of a staff using traditional planning tools during the exercise forced the research to search for other planning efforts to provide a basis for comparing the results of the CAPES planning.

The actual planning staff in the 1973 battle did not use CAPES as a planning tool. The historical plan and events that unfolded leading up to the 1973 war provided a foundation that evaluators could use to compare against a CAPES produced plan. Although separated by over thirty years the two planning efforts shared a number of similarities and benefits. Both planning efforts began using the same initial situation. Each had similar organizations, dispositions, and fighting equipment. The historic "road to war" of the 1973 Yom Kippur War was replicated for the SAMS planners. The comparison did not require large amounts of additional resources. CAPES was already being used by the SAMS planning staffs as a digital tool during the exercise.

The conduct of the evaluation required no additional resources. Evidence of CAPES success or failure as an information system was an unplanned benefit of the exercise. The exercise also allowed easy access and observation of the staffs using the new planning tool. The academic environment allowed planners to use new ideas and techniques. The open environment gave observers open access to problems and limitations experienced by student planners.

Consequently, the December 2003 exercise conducted by the SAMS students used history to provide a road to war and establish the initial environment for the planning staffs. The historical context provided a framework that helped define the problem. The historical background also provided a basis for assessing the planning effort conducted with CAPES.

The historical scenario set the initial planning conditions more broadly than was originally envisioned. Instead of simply providing the strategic conditions and the initial locations of forces, the scenario shaped the command and control environment, which ultimately made assessment of the CAPES software difficult. To understand the impact of the scenario on the test it is necessary to review first the historical conditions.

Historical Middle East Conflict

The geographic region now known as Israel has been the site of numerous conflicts for the last twenty-five hundred years.⁵⁴ At least nine different empires have ruled or controlled this region of the Middle East since 587 years before the common era (BCE). The Romans, the fourth empire to occupy Israel, destroyed the Jewish religious temple and exiled the Jewish people.⁵⁵ It was not until the 19th Century when the United Kingdom ruled Palestine that the Zionist movement began the gradual return Jews to Israel from their scattered settlements around the

⁵⁴ "Facts About Israel: History." Internet: <http://www.mfa.gov.il/mfa/go.asp?MFAH00kt0>. Accessed 3 February 2004.

⁵⁵ "Israel Science and Technology Homepage: Brief History of Israel and the Jewish People." Internet: <http://www.science.co.il/Israel-history.asp>. Accessed 3 February 2004.

world.⁵⁶ Tensions between native Palestinians increased as Jewish numbers grew. Culturally and religiously different people competed for the same lands as settlements spread. The Arab opposition to the emerging idea of an Israeli state intensified. Violence escalated again after the Arab nations rejected the United Nation's November 1947 Partition plan and declared a Jihad or "Holy War."⁵⁷ War officially began in May 1948 when the Israeli Declaration of Independence established the Army of Israel.⁵⁸ Hostilities continued until 1949 when the United Nations (UN) helped negotiate an armistice between Israel and each of the Arab nations involved.⁵⁹ The Arab Coalition had failed to prevent the establishment of Israel. The United Nations arranged armistice agreement was accepted by the Arab coalition and affirmed the independent state of Israel. However, the Arab Coalition refused to acknowledge it as a legitimate government even though it accepted the armistice.⁶⁰ Israel had been victorious in its war of independence; a conflict the Arabs would forever call the "Disaster of 1948."⁶¹

War between Israel and its Arab neighbors did not end in 1948. In 1956, Egypt nationalized and seized the Suez Canal. Israel after learning that the British and French planned to recover the Canal Zone by force, offered to assist the two European governments in their plans to restore the status of the Canal. In return for its cooperation, Israel asked for much needed weapons and equipment for its new and growing army. The Israeli portion of the attack was successful and the Israeli Defense Force (IDF) achieved a impressive tactical victory through speed, audacity, and mobility.⁶² This tactical success was negated, however, by a strategic political defeat. The United States joined the Soviet Union in demanding that Israel, Great

⁵⁶ Tevor N. Dupuy, *Elusive Victory: The Arab-Israeli Wars, 1947-1974*. (Fairfax, VA: Hero Books, 1984), xviii.

⁵⁷ Ibid., 11.

⁵⁸ Daniel Horowitz and Edward N. Luttwak, *The Israeli Army, 1948-1973*. (Lanham, Maryland: University Press of America, 1975), 1.

⁵⁹ Ibid., *Elusive Victory: The Arab-Israeli Wars, 1947-1974*, 114.

⁶⁰ "Arab-Israeli Wars History Text." Internet: <http://www.palestinehistory.com/wartext.htm>. Accessed: 3 February 2004.

⁶¹ Ibid., *The Israeli Army, 1948-1973*, 1.

Britain, and France evacuate Egyptian territory. The attacking countries complied with the United Nation directive and withdrew from the area. A United Nation's Emergency Force (UNEF) deployed to supervise the cease-fire and monitor the Canal Zone.⁶³ Strategically the war accomplished nothing for the Israel.⁶⁴ On the battlefield however, the Israeli Defense Force proved itself as a noteworthy ground force.

Israel enjoyed a time of relative calm between the 1957 Sinai Campaign and the next conflict of significant size, the June War of 1967.⁶⁵ In 1967, Egypt closed of the Suez Canal, the key-shipping lane for Israel and the region, and Egypt demanded removal of United Nation's Emergency Forces. Those actions provoked Israel to attack Egypt once again. On June 5th, 1967 the Israeli Air Force attacked and destroyed an unprepared Egyptian Air Force still on the ground at eleven airfields.⁶⁶ The surprise attack destroyed the Egyptian Air Force during the first three hours of battle.⁶⁷ The Israeli Defense Force (IDF) continued with its plans to defeat the Egyptian Army and then turn on the Jordanian and Syrian Armies.⁶⁸ First, the three Israeli Divisions in the Sinai quickly defeated the Egyptian defenses. When Syria did not react to the hostilities initially, they eliminated themselves from the fight. The Israelis, therefore, attacked Jordan and then moved a brigade into the Golan Heights.⁶⁹ The Israelis had developed a new doctrine that allowed decentralized control and relied on flexibility, leadership, and surprise.⁷⁰ In a dramatic

⁶² Thomas E. Griess, *The West Point Military History Series: The Arab-Israeli Wars, The Chinese Civil War, and the Korean War*, Wayne. (New Jersey: Avery Publishing Group Inc., 1986), 9.

⁶³ Ibid., "Arab-Israeli Wars History Text."

⁶⁴ Ibid., *The West Point Military History Series: The Arab-Israeli Wars, The Chinese Civil War, and the Korean War*, 9.

⁶⁵ Ibid., *The Israeli Army, 1948-1973*, 165.

⁶⁶ Ibid., *The West Point Military History Series: The Arab-Israeli Wars, The Chinese Civil War, and the Korean War*, 11.

⁶⁷ Frank Aker, *October 1973: The Arab-Israeli War*. (Hamden, Connecticut: Archon Books, 1985), 6.

⁶⁸ Ibid., *The West Point Military History Series: The Arab-Israeli Wars, The Chinese Civil War, and the Korean War*, 12.

⁶⁹ John D. Burt, "Organized Chaos: Israeli Defense Doctrine and Tactics," *Strategy and Tactics*, May 1994, 17.

⁷⁰ Ibid., *The West Point Military History Series: The Arab-Israeli Wars, The Chinese Civil War, and the Korean War*, 12.

fashion, Israel successfully won the conflict outnumbered and outgunned. Not only had the Arab forces been defeated, they had lost a substantial territory. Israel increased its size almost fourfold by adding 26,476 square miles.⁷¹ Israel took possession of the Sinai Peninsula, the west Bank, and the Golan heights.⁷² The crushing defeat of the Arab coalition suggested that it would take years to rebuild to a level that would allow them to threaten Israel in another armed conflict. The Israeli victory and Israel's future strategy rested on three military pillars: intelligence, air power, and armored forces. Together Israel fought and readily defeated a superior force. This victory over the combined Arab States elevated Israel to a regional superpower.⁷³ These events provided the backdrop for the situation that was chosen for the practical exercise. Some historians define the Yom Kippur War as the most "intense, conventional, non-nuclear war" in the Cold War period.⁷⁴ In total 7000 men, 1,600 tanks, and 85 aircraft were lost.⁷⁵

Six years had passed since the swiftly executed war of 1967. The pause allowed both sides to reflect on the lessons of the Six Day War. Each drew on the lessons learned as they continue to clash with each other, sometimes learning more through failure than success. The Israeli victory in 1967 was so large that the Israeli military did not see the need to scrutinize or examine any of its military weaknesses. Israel focused on the strengths of its military and failed to recognize shortcomings in the development of combined arms warfare, technology balance, fixed defenses, rapid mobilization requirements, reserve munitions and equipment stock, and centralized command.⁷⁶ Instead, Israel focused on the problem of absorbing its newly occupied

⁷¹ George W. Gawrych, *Leavenworth Papers. Number 21, The 1973 Arab-Israeli War: The Albatross of Decisive Victory* (Washington D.C.: US Army Center of Military History, 1996), 3.

⁷² Ibid., "Arab-Israeli Wars History Text."

⁷³ Ibid., *Leavenworth Papers. Number 21, The 1973 Arab-Israeli War: The Albatross of Decisive Victory*, 2.

⁷⁴ Ibid., *October 1973: The Arab-Israeli War*, 2.

⁷⁵ Ibid., and Ibid., "Organized Chaos: Israeli Defense Doctrine and Tactics", 18. Burt states a discrepancy in numbers lost in the battle. More men (38,000) and less tanks (800).

⁷⁶ Anthony H. Cordesman and Abraham R. Wagner, *The Lessons of Modern War, Volume I: The Arab-Israeli Conflicts 1973 – 1989* (Boulder, Colorado: Westview Press, 1990), 21.

territories.⁷⁷ Most importantly, the Israelis underestimated the Arabs, expecting them to fight the next war as poorly as they had fought in 1967.⁷⁸ The Israelis neglected to make an effort to maintain their level of advantage. Their attitude of invulnerability also existed politically in Israel. The perception of a mismatch between the Arab military capabilities and Israel caused the Israeli government to reduce the proportion of the Gross National Product (GNP) allocated to defense spending. Officials felt that long-term economic growth was more important to the defense of Israel than short-term military advancement.

The Egyptians, however, gradually built up military strength between 1971 and 1973. The Arab Coalition, under an extensive deception plan, surprised the Israeli's with a massive attack.⁷⁹ The Arabs did not want a repeat of the Six-day war of 1967 and prepared accordingly, while Israel was clearly "preparing to fight the last war rather than the next one."⁸⁰ Israel was content and confident in the ability of its defense force. They assumed it would take much longer for the Arab Coalition to rebuild its military force. They also believed that when that force was ready it would resemble the force of 1967 and be easily defeated. Israel was wrong, and only six years after its last conflict with the Arabs they found themselves at war again.

Golan Heights – 1973

Egypt joined Syria in a war against Israel to regain the territory lost in 1967. The Arab states struck unexpectedly on 6 October 1973 one of the most holy days of the Jewish calendar that year Yom Kippur.⁸¹ The Arab plan for the conduct of the operations was well coordinated and simple. They attempted to force the Israelis to defend against two simultaneous attacks along

⁷⁷ Ibid., 19.

⁷⁸ Ibid., *Leavenworth Papers. Number 21, The 1973 Arab-Israeli War: The Albatross of Decisive Victory*, 1.

⁷⁹ Ibid., *The Lessons of Modern War, Volume I: The Arab-Israeli Conflicts 1973 – 1989 of War*, 22.

⁸⁰ Thomas Walczyk, "October War: Doctrine and Tactics in the Yom Kippur Conflict 6-24 October 1973," *Strategy and Tactics*, March 1977, 4.

two fronts. In the South, Egyptians crossed the Suez and set up a strong defense under a robust air defense umbrella. The Egyptian defense waited for the Israeli counter attack and planned to defeat that attack with handheld anti-tank and anti-aircraft weapons.

In the north the Syrian offensive attempted to take back the Golan Heights, drive west to the Mediterranean Sea, and divide Israel in half. This attack in conjunction with the southern attack on the Suez Canal sought to force Israel to fight on two fronts and separate its limited forces.⁸² Syria could then control the northern highlands of the Golan Heights and remove the threat to the Syrian capital, Damascus.⁸³ Egypt would again control the Suez Canal, regaining its position of relevance in the region, and damage Israel's high level of confidence.⁸⁴ While Egypt attacked in the south, Syrian forces advanced forces into the Golan Heights.

The Golan Heights is a 20 kilometer wide by 60 kilometer long plateau that separates Syria from Israel along disputed lands.⁸⁵ After taking this key terrain during the 1967 war, Israel defended along the front to prevent Syrian indirect fire attacks into the cities north of the Sea of Galilee and to shelter the watershed that flows westward, supplies the fertile Huleh Valley, and creates the headwaters of the Jordan River. This watershed is one of only three fresh water sources for Israel.⁸⁶ The Israelis identified an Arab occupied Golan Heights not only as an area from which enemy forces could range the people of the Huleh Valley with indirect fire, but also as a forfeit of a water supply, a major natural resource required for survival in the arid region.

The high ground of the Golan Heights provides the occupier with clear observation both westward, overlooking the Huleh Valley and eastward all the way to the city of Damascus, 70

⁸¹ Ibid., "Arab-Israeli Wars History Text."

⁸² Ibid., *The West Point Military History Series: The Arab-Israeli Wars, The Chinese Civil War, and the Korean War*, 16.

⁸³ Ibid., *October 1973: The Arab-Israeli War*, 19.

⁸⁴ Ibid., "Organized Chaos: Israeli Defense Doctrine and Tactics," 18.

⁸⁵ "The History of the Golan." Internet:
http://www.unitedjerusalem.com/THE_GOLAN/the_golan.asp. Accessed 3 February 2004.

⁸⁶ "Peace with the Golan: Water Issues of the Golan Heights." Internet:
<http://www.golan.org.il/water.html>. Accessed 7 February 2004.

kilometers away.⁸⁷ The active defense force that occupied the front line consisted of 170 tanks and 10 artillery batteries. Forces were positioned in seventeen observation points spread along the 60 kilometer line that separated Arab and Israeli forces.⁸⁸ Only four roads moved over the rough volcanic terrain. Israel improved the defensive position by creating a patchwork of minefields, and anti-tank obstacles to include a wide tank ditch.⁸⁹ Reserve or mobilized forces also could occupy a number of preplanned ambush sites created by the volcanic spires called “tels” along the plateau.⁹⁰ In additions to the seventeen active observation posts the Israelis kept a ready highly mobile reserve consisting of two armored brigades established to provided the punch to the defense.⁹¹ Many considered the Israeli defensive preparations along the Golan Heights superior to those along the Suez Canal Bar Lev line. The Arab Coalition would soon test these defenses.

The Syrians began the attack to the north at 2:05 p.m. with an enormous artillery and air bombardment of the Israeli defenses.⁹² Under the cover of an hour long shelling the Syrian Army moved three divisions forward to attack.⁹³ Fifty minutes later the Syrian artillery preparation was complete and columns of vehicles moved forward.⁹⁴ Engineer vehicles led to clear the defensive obstacles. Immediately thereafter, assault tanks and infantry carriers advanced ready to bring the fight to a substantially smaller force.⁹⁵

Along the northern portion of the Golan Heights front, the 7th Armored Brigade easily stopped the initial advances of the Syrian 7th Infantry Division. The only significant Syrian gain

⁸⁷ Ibid., *October 1973: The Arab-Israeli War*, Oct '73, 4.

⁸⁸ Ibid., *The West Point Military History Series: The Arab-Israeli Wars, The Chinese Civil War, and the Korean War*, 16.

⁸⁹ Ibid., *October 1973: The Arab-Israeli War*, Oct '73, 7.

⁹⁰ Ibid., *The West Point Military History Series: The Arab-Israeli Wars, The Chinese Civil War, and the Korean War*, 16

⁹¹ Ibid., *Elusive Victory: The Arab-Israeli Wars, 1947-1974*, 42

⁹² Ibid., *The West Point Military History Series: The Arab-Israeli Wars, The Chinese Civil War, and the Korean War*, 16.

⁹³ Ibid., *Elusive Victory: The Arab-Israeli Wars, 1947-1974*, 445.

⁹⁴ Ibid., *The Lessons of Modern War, Volume I: The Arab-Israeli Conflicts 1973 – 1989 of War*, 25.

along that front was the capture of the northern observation post on the highest point overlooking the Golan, Mount Hermon.⁹⁶ In the south however, the Syrian advances was more successful. The 5th Syrian Mechanized division broke through the 188th Barak Brigade using a combination of surprise and mass over more maneuverable terrain.⁹⁷ Some authors indicate the Syrian advantage may have been as high as twelve to one in terms of tanks.⁹⁸ The Israeli reinforced mobile reserve force sent into the south of the Golan began to crumble along the purple line.⁹⁹ Although the Syrians lost heavily in their attack, they were able to penetrate the Israeli defenses at several locations.¹⁰⁰ Israelis were able to destroy a number of Syrian forces as they defended from the preplanned ambush sites.¹⁰¹ The Syrian forces continued to advance against the outnumbered Israelis but not without sacrifice. The Arab Coalition, more successful than anticipated, soon found itself operating at the limits of its supplies and its plan. No one, including the Israelis, anticipated such a deep initial penetration.

On the 7th of October, in the south the 188th Barak Brigade continued to struggle even as a newly mobilized infantry and reserves were filtered forward by desperate Israeli leaders. The Syrians slowed and did not exploit their initial success. What caused this pause in the battle is still being debated. Some believe that the Syrian leadership was overconfident. Others feel the Syrian Army lacked a follow on plan supporting their initial success. Without a plan, the normally centrally controlled subordinate leaders lacked initiative to continue the attack forward.¹⁰² Still others believe the Syrians had outrun their supply lines and forces needed fuel

⁹⁵ Peter Allen, *The Yom Kippur War* (New York: Scribner's Sons, 1982), 71.

⁹⁶ Ibid., *Elusive Victory: The Arab-Israeli Wars, 1947-1974*, 42.

⁹⁷ Ibid., *The West Point Military History Series: The Arab-Israeli Wars, The Chinese Civil War, and the Korean War*, 18.

⁹⁸ Ibid., *October 1973: The Arab-Israeli War*, Oct '73, 76.

⁹⁹ Ibid., *The West Point Military History Series: The Arab-Israeli Wars, The Chinese Civil War, and the Korean War*, 18.

¹⁰⁰ Ibid., "Organized Chaos: Israeli Defense Doctrine and Tactics," 18.

¹⁰¹ Perry Moore, "OPERATION SHOCK TROOP: The Drive on Damascus, October 1973," *Strategy and Tactics*, May 1994, 6.

¹⁰² Ibid., *Elusive Victory: The Arab-Israeli Wars, 1947-1974*, 42.

and ammunition to continue.¹⁰³ Whatever the reason, the tide of the battle turned late 7 October. Combined with this pause by Syrian forces, the trickle of Israeli mobilized reserve became a flood. On the morning of October 8th Israel seized the initiative in the southern Golan. Gaining initiative however was not without cost. Diverting forces from the initially successful north achieved the renewed success in the south. However, the Israelis were able to hold out and on 9 October were able to turn to the offensive across the entire Golan front.¹⁰⁴ By October 10, four days after the attack they had regained the ground initially lost and moved across the line that marked the initial defensive positions or purple line.¹⁰⁵

The Israeli Defense Force turned the tide of the battle and by 12 October advanced to within 32 kilometers of the Syrian capital Damascus.¹⁰⁶ In positions around Damascus, and with artillery ranging the city, Israeli forces remained in consolidated positions able to repel Arab limited and uncoordinated counterattacks until the ceasefire.¹⁰⁷ Israel had survived the initial shock of the Arab attack. The Israeli Defense Force was successful in its rapid mobilization of forces. It successfully stopped the Arab attack, repelled Arab forces, and maintained control over vital national interests.

The war finally halted when other Arab States came to the aid of their companions. On 17 October, Arab oil producing states cut oil production and raised its price by 70 percent. The Arab nations began to use economic power as a way to bring global political pressure on Israel and their allies.¹⁰⁸ The Arab nations had discovered a new way to apply pressure on Israel and

¹⁰³ Ibid., "OPERATION SHOCK TROOP: The Drive on Damascus, October 1973," 6.

¹⁰⁴ Ibid., *Elusive Victory: The Arab-Israeli Wars, 1947-1974*, 42.

¹⁰⁵ Ibid., "Organized Chaos: Israeli Defense Doctrine and Tactics," 18.

¹⁰⁶ Ibid., "The History of the Golan."

¹⁰⁷ Ibid., *Elusive Victory: The Arab-Israeli Wars, 1947-1974*, 42.

¹⁰⁸ Ibid., *Leavenworth Papers. Number 21, The 1973 Arab-Israeli War: The Albatross of Decisive Victory*, 71.

their allies. The new economic tool forced Israel's western allies to carefully investigate the costs before supporting Israel.¹⁰⁹ This new pressure forced Israel to be more independent.

Israel successfully counterattacked and regained all its lost territory.¹¹⁰ However, the Israeli victory was not without cost. Weeks of intense fighting and high casualties drained Israeli moral. The Israelis now faced the significant economic challenge of rebuilding its defense force. The Israelis did not achieve a decisive victory over the Arab coalition but had defended its borders. The Arab Coalition struck a blow to Israeli self-confidence and regained cultural self-respect and honor. To this day, both sides continue to maintain they were victorious, and the region remains in conflict.

The Practical Exercise

The historical events, previously described, establish a series of tasks to drive both student planning and the CAPES assessment. The events on both the Golan and Sinai fronts provided the planning teams the opportunity to plan attacks, counter attacks and a defense. It also provided different terrain conditions; a restricted area along the Golan and an open space in the Sinai. Thus, the history of the 1973 war seemed to provide a means to test CAPES' utility in a variety of challenging planning tasks.

The circumstances leading up to the beginning of the planning process mirrored the events that occurred in the Middle East leading up to 1973. Unit equipment, disposition, and organization remained consistent with the historic situation found along the Golan Heights in October 1973. Once planning began, however, the feedback provided from the simulation driving the exercise provided results that deviated from history. Orders from each of the planning groups were transferred into the Decisive Action (DA) simulation software. This computer run

¹⁰⁹ Ibid., *The West Point Military History Series: The Arab-Israeli Wars, The Chinese Civil War, and the Korean War*, 22

¹¹⁰ Ibid., *Leavenworth Papers. Number 21, The 1973 Arab-Israeli War: The Albatross of Decisive Victory*, 74.

war-game simulation processed the orders and plans from each of the headquarters to determine a likely outcome. These outcomes provided the starting conditions for the next planning effort by the headquarters. The simulation provided situational updates that replicated reports from subordinate units to the AMSP staffs. The exercise also used an adjudication cell to provide feedback to the staffs during the weeklong exercise. This adjudication cell provided information to the planning staffs not available from the simulation supporting the exercise. The simulation was able to provide most information about subordinate organizations. The exercise required an adjudication cell to answer questions about higher headquarters intent and political strategies. The adjudication cell also provided information to fill holes or inconsistencies created by incomplete data from the simulation. The exercise included two levels of headquarters. This required students to interact with student to collect some of the information needed to conduct planning. The planning staff layout created an environment that generated interaction among staffs as they conducted parallel planning.

Staff Organization

The planners in this case were students in the Advance Military Studies Program. All are officers who have completed the requirements for the Command and General Staff Officers Course (CGSOC) and been selected to continue for a second year of studies of the military art. The majority of officers are newly promoted field grades officers in the rank of major preparing to return to the tactical army as staff officers between at a headquarters between the battalion and corps. During the exercise, the students split into six smaller groups. Each small group created an individual planning staff that represented one of the separate headquarters throughout the region. The smaller staffs consisted of twelve to fourteen students. Each student assumed a role on the staff as a primary staff planner. A School Advanced Military Studies Seminar Leader acted as a both a commander and senior mentor for each of the smaller planning groups. They provided relevant guidance and intent as they role-played the commander for each of the

headquarters. Three of the small groups represent headquarters from the Israeli Defense Force and three groups represented headquarters from the Arab Coalition. One planning group acted as the planning staff for the Israeli and Arab senior headquarters, the Israeli Defense Force headquarters and the Arab Coalition headquarters. Each Higher headquarters controlled two subordinate staffs. Two small groups replicated the Egyptian and Southern Israeli Headquarters fight in the Sinai. The final two groups focused on the Golan Heights simulating the Syrian and Northern Israeli Headquarters. Although the modern exercise staffs planned as these historic headquarters, they had a number of modern tools to assist them in their planning effort and the results of their planning did not need to replicate the historical plan.

Because it was not possible to observe all the planning groups, the decision was made to concentrate attention on the headquarters for the Northern Israeli Front. This choice permitted detail observations of the planning effort. Although not specifically observed other small groups conducting the exercise seemed to have results similar to those seen in Israeli Northern Front Headquarters. One difference noted during the exercise, however, was the variety of ways the staffs used CAPES. Some attempted to use CAPES as the focus of the planning effort while others had limited use for the system.

Planning Tools

The Advanced Military Studies Program exercise provided the planning staffs a number of tools currently found at tactical U.S. Army headquarters. Each of the planning areas had access to three laptop computers loaded with the Combat Arms Planning and Execution Monitoring System (CAPES) software package. A local area network (LAN) allowed these computers to electronically connect to each other. This connectivity allowed three staff officers to work on the same plan simultaneously using the collaboration function available in CAPES. In addition to communicating with the other CAPES computers in the same headquarters, the local network allowed staffs from different headquarters to share plans and information. Planners were

able to share files and information by email, Microsoft NetMeeting, or by storing data on a shared common computer hard drive.

A second local area network also existed. This network, like the CAPES network, allowed staff officers from every level of command to communicate with each other. Unlike the CAPES computers, there were multiple desktop computers in each room. Every staff officer was assigned his or her own computer. These computers provided the planners the standard Microsoft suite of office productivity tools. The computers also had access to the unclassified Internet. The Internet connection proved useful for planners as they conducted research on equipment, terrain, and politics of the region. Each planning area had the ability to project the images from both computer networks to a large display board. The staff used these electronic white boards for briefings and group discussions. It gave the staffs the ability to use digital technology in a traditional briefing environment. Staffs and commanders were able to display digital maps on the white board directly from CAPES. Information sharing did not require extensive manipulation of data or the printing of paper handouts. A number of communication options existed in addition to the capabilities provided by the two computer networks.

Video teleconference and telephonic communication were available between each of the acting headquarters. However, these capabilities were troublesome to operate. The staffs found ways to work around the difficulty of operating the voice and video communications. The distance between staffs was not substantial. Face-to-face conversations and coordination was common between the staff. Information was often passed in person between higher and lower commands because of temporary problems with the LAN. Direct communication was also more convenient and provided better results. Many students like planners in the field reverted to customary and traditional planning techniques when time became short or the situation unfamiliar.

Training

Training proved a problem for the CAPES assessment. Few students were exposed to Army digital planning tools before attendance at the Command and General Staff College. The Advanced Military Studies Program familiarized each student with digital systems to prepare them for the exercise. This familiarization prepared them for tactical unit assignments after the completion of the program. These units are now extensively using digital tools to assist in planning and execution of their operations. To prepare students for the exercise and future assignments each student attended forty hours of training on one of two systems. Students were allowed to choose between an automated system focused on execution and one focused on planning. The half that selected execution received a basic introduction to the Army Battle Command System's Maneuver Control System (MCS). The other half, selected a planning focused system, studied CAPES. Originally, the exercise plan included the use of MCS but compatibility problems forced the exercise director to remove it from the design. The training on MCS was not wasted. Every student will see MCS again sometime in their career, as the U.S. Army continues to field the Army Battle Command System.

The students trained on CAPES, however, expected to see the system before they arrived at their next assignment. The Digital Leader Development Center provided instructors to familiarize students with CAPES. During this instruction, students quickly learned the basics of CAPES operation. Students spent four hours daily in briefings and performing practical exercises in CAPES. Initially the instruction focused on the basic operation of the software and the simple creation of operational graphics. Soon the instruction taught students to position, move, and task units. Students learned how the system replicates tasks taking into account the effects of terrain, logistics, and unit. The instructors demonstrated these effects initially using single units. Students learned, after the first week of instruction, to manipulate and coordinate multiple units.

The training showed how to coordinate and synchronize movement and fires to mass forces on a desired objective.

The final portion of the instruction showed how CAPES shares information and orders between staff officers and other organizations. CAPES has two unique methods to transmit an envisioned concept of operations. The first uses traditional Operations Orders (OPORD) format. After developing a plan in CAPES planners can request the program to create five paragraph operations orders or synchronization matrixes. The system creates either product electronically using doctrinal templates in either a Microsoft Word document or Excel spreadsheet respectively. These products, however, are not complete and must be edited by the staff. The computer generated product remains vague and the actual plan requires more resolution than the system can now provide.

The second method a staff disseminate plans is by sharing actual CAPES products. Staffs can share operational graphics and concepts of operation either as an isolated file or in a collaborative environment. Sharing an isolated CAPES file is no different than sharing any other document. Once saved, a staff can email, file transfer protocol (FTP), or share data on a common network drive. CAPES also lets separate systems connected by a network interact with each other. In this collaborative environment, one system can watch another or multiple systems can interact. If the systems are interacting with each other, every system can create, change or delete a common plan. Collaboration at this level requires strict rules and protocols. Forty hours of instruction did not advance the students to a level of expertise capable of working CAPES in a collaborative environment.

The exercise director understood that the students were only familiarized with the new automated system. To assist the students, CAPES subject matter experts (SME) were available during the exercise week to support the planners' efforts to use the tool. These experts helped students by revisiting previous lesson material and exposing them to new techniques not covered in the initial forty hours of instruction. However even with the assistance from the contractors,

much of the automated benefits CAPES provides went unused. Students uncertain and sometimes frustrated reverted to a planning process without CAPES.

OBSERVATIONS

The student conducted the planning exercise using CAPES during a one-week event. During that week, observations in three discrete areas presented themselves. The exercise compelled staffs to focus on the execution of small unit engagements as opposed to the visualization of activities throughout the entire Northern Front area. Although familiarized on CAPES, staffs struggled to use the system as an effective planning tool. Planning staffs did not possess the proper connectivity, system training, or staff procedures to use CAPES to its fullest capability.

The exercise did not allow the staffs to conduct planning at the operational level. During the week, staffs were required to prepare orders for and present information to the adjudication cell and simulation nightly. Each day began with an update of unit locations and combat strengths. The staff then spent the entire day preparing orders and control measures for operations that would occur that night. The next day the process repeated itself. This created an environment consisting of rapid execution cycles. The staff quickly focused on the tasks related typically performed by staff officers serving in a current operations cell. They became fixated on the close fight and not on to planning future operations. The Israeli Northern Front headquarters quickly became focused on the how each brigade would fight along on the Golan Heights.

A great majority of Israeli forces were mobilized before conducting operations. This process gradually introduced forces into the operation again focused the planning staff's attention on smaller sized units. Simulation requirements also focused attention on small units. The simulation providing feedback for the exercise required movement and battle tasks for each individual brigade size element. The Northern Front had no subordinate staffs and, therefore, was required to plan down to that level. Originally, the exercise hoped to create conditions that

allowed students to develop an operational plan. However, the exercise also did not provide an operational design for staff officers to use.

Early in the planning process, the staff encountered difficulties understanding the function of CAPES. CAPES provided a great deal of information, however, students did not know how to use this information best. CAPES provided information that supported mission analysis, course of action (COA) development, and wargaming. Initially exercise planners believed the data CAPES provided would primarily be displayed using other manual and automated tools. Planners developed these products on paper, acetate, or computer PowerPoint slides. Planner's initially believed that CAPES was only a wargaming tool. Later staffs learned to use the planning tool to build decision products in CAPES and to present those products effectively using CAPES instead of transferring the information to another tool. Most of the planners took most of the exercise time to determine how to conduct basic operations in the CAPES software. Planners began the week creating potential courses of action (COA) using the information provided by CAPES using butcher paper or whiteboards. By the end of the week they had learned to create similar COAs in CAPES. The staff then briefed the concept by projecting the digital image. The commander and staff could then review the product and make instantaneous changes if needed.

Student planners during the exercise used few of the collaborative tools available. The Northern Israeli planning staff used neither video teleconferencing nor NetMeeting. The primary means of communication was face-to-face conversation, telephone, or file transfer using shared network storage. The Israeli staffs also disseminated their orders in a traditional manner. PowerPoint graphic files and synchronization matrixes provided the detail for subordinates to develop their plan. The Israeli Defense Force Headquarters did not attempt to send CAPES files to subordinate units. Any higher orders or control graphics created by the IDF were reproduced at the Northern Front headquarters. Much of this effort was repetitive. The Northern Front planning staff could have used this time refining their plan rather than recreating work already

completed at higher levels. This was not the only time saving measure not utilized during the exercise.

Subordinate planning staffs waited until completion of the higher headquarters order before incorporating those tasks into their scheme of operations. The distribution of the order was also traditional. The higher headquarters created and packaged the entire plan and only then passed it to subordinate units. Lower level organizations waited until completion of the higher order before extracting pertinent information needed during their planning process. The potential exists in CAPES for staffs to plan simultaneously. The planners did not use this capability. The student planners did not understand the system well enough to create a true collaborative planning environment. Additionally no standard operating procedures existed between the staffs to facilitate concurrent planning. Planners within the Northern Front Headquarters Attempted to use the collaborative capabilities found in CAPES. Two laptop systems were connected in a collaborative session for one day. Two staff officers, however, were still not able to enter data to support one plan. Again, the procedures to deconflict two separate inputs, entered simultaneously were not in place on the immature staff.

Because CAPES was not used in a collaborative manner a large amount of staff effort was duplicated. Staffs at each level were required to analysis the same problems or issues again. The staff 's time is better spent focused on new emerging issues. Combining the analysis of a superior and subordinate headquarters increases the accuracy of a commander's situational understanding. It uses the power of two staffs to tackle common issues and allows the commander to focus the required intuitive decisions on more intricate issues.

CONCLUSIONS AND RECOMMENDATIONS

The research conducted for this evaluation attempted to compare two planning processes. The design sought to determine whether CAPES assisted commanders and staffs as they planned operations. However, even before the conclusion of the experiment, problems appeared in the

comparison. These problems prevented a proper assessment of CAPES. The problems identified were substantial enough to prevent making any conclusions about the merits of CAPES as a planning tool. Although these problems interfered with the original goal of the experiment, they provided some insight for the conduct of future comparisons. Identifying the problems that occurred in this study provides a record of potentially contentious issues. Future evaluators can use this list of problems and concerns to scrutinize future comparisons during the early stages of comparison design. Early identification and resolution of these concerns will alleviate many of the problems encountered during this exercise and strengthen the results of future evaluations.

Three major issues appeared to interfere with the evaluation of CAPES. These complications did not become apparent until the exercise began. Only later was it possible to look back and determine exactly why the problems occurred. The selection of a scenario created a significant obstacle to determining whether CAPES assisted the staff as a planning tool. The introduction of new automated planning tools such as CAPES requires a substantial investment in training. Without this training, it becomes difficult to determine the merits of the system under investigation. Finally, a tool designed for use in a collaborative environment cannot be used properly in isolation. Planners and evaluators will not see the full effect of CAPES unless supported by other subsystems of ABCS. CAPES relies on these other subsystems to process data and create relevant information. Without them and the information they provide, the planning tool is not as useful. Any one of these obstructions alone might have defeated the evaluation of CAPES. The comparison was sure to fail when all three problem were introduced simultaneously.

Scenario Selection

The U.S. Army has been using one of the many versions of CAPES since 2001 when it was still called the Battlefield Planning and Visualization (BPV) tool. Developers, testers and staffs have used the planning tool in a number of tests, exercises and real world operations.

Selection of any one of those conditions would have provided a means to investigate the usefulness of CAPES. However, a number of factors indicated the Arab-Israeli War exercise conducted by the Advanced Military Studies Program would provide a good scenario to investigate the merits of CAPES.

The School of Advanced Military Studies did a great deal of work preparing the exercise before the commencement of this study. A number of benefits made the exercise a convincing choice. No changes were needed to fit the exercise into the comparison. The school had already invested resources to develop, plan, and execute the exercise. The exercise provided easy observation of the planning staffs using CAPES. Most importantly, the objectives of the exercise corresponded to the focal point of the comparison. The exercise included the use of digital command and control systems. However, with these benefits came weaknesses.

The exercise used history to provide the road to war for the planning efforts. This meant that both the historic and modern headquarters started their planning effort using relatively equal conditions. This was, however, not the case. The initial conditions established before the exercise were not historically accurate. The exercise staff differed in a number of ways from the historic Israeli staff of 1973.

The Israeli Defense Force (IDF) had been officially fighting against the Arab Coalition for over 25 years. In some of the conflicts, the IDF was successful and in others, it failed. These experiences had shaped how the IDF fought. The IDF developed and reinforced those techniques they found effective against the Arab forces. These reinforced strengths became the new Israeli doctrine. Before the 1973 war, the Israelis had enjoyed a great success in the 1967 Six Day War. The success of that battle was based on intelligence, air power, and armored forces. Even outnumbered, the Israelis emerged victorious from the battle and gained large amounts of territories from the Arab Coalition.¹¹¹ Israeli experience also taught them to decentralize control

¹¹¹ Ibid., 5.

to subordinate commanders on the battlefield. The IDF incorporated these successes into their doctrine.

The students acting as the staff for the exercise used a different doctrine. Their background and mindset was developed by a distinct set of U.S. military experiences and training. The student's previous assignments had exposed them to U.S. Army doctrine for over twelve years. That exposure was against different forces, equipment, and environments. Most recently, they had studied doctrine at the tactical and operational level for the past 18 months in on of the Command and General Staff College's programs. The doctrine they studied was very different to that followed by the Israelis. In contrast to IDF doctrine, they focused on current U.S. military doctrine. U.S. doctrine centers around combined arms warfare, technology balance, and a centralized command. CAPES was designed to support a staff planning using this U.S. doctrine. Because CAPES supports a command and control doctrine distinctly different from the Israelis, the planning requirements did not replicate those of the IDF. In other words, a decentralized battle cannot be planned using a tool designed for a doctrine that focuses on centralized planning.

Additional influences also affected the staffs. A number of pressures that existed in 1973 were not present during the modern day exercise. Although stressful, an exercise cannot create the environment found a headquarters preparing for a real operation. The Israeli staff understood that the decisions they were making might determine the survival of their country. If the Arab Coalition successfully attacked along the northern front, they likely could split Israel in two. The students did not feel these pressures when they planned for the operation. The level of anxiety experienced was not the only difference between the historic and exercise staffs. The two staffs were distinct in other ways.

Staff Training

The staff planning operations during the exercise consisted of fourteen students, most whom had only met six months prior when the AMSP curriculum began. The student planners had never worked as a team before. They never worked collectively to solve a military problem. It was what is known as an ad hoc staff. The staff positions each student occupied were unfamiliar to him or her. Most students worked outside their tactical expertise. Most staffs in the U.S. Army train six to twelve months to become a stabilized staff that understands how each member contributes to planning and military decision-making. This is very different from the historical planning staff. The Israeli staff had worked together for a number of years. The staff was well versed as a team and focused on the problem at hand. The staffs had labored over the real issue of the Golan Heights. Even though not at war, the conflict between the Israelis and Arabs continued. It is unfair to put two such distinctive staffs against each other and claim one can plan better based solely on the addition of a new planning tool.

The Israeli staff also had a much better understanding of the problem. The students prepared for the exercise by conducting a weeklong study of the events in the Middle East. This history included events throughout the region over many years. Students studied broadly and discussed events after World War II, including regional issues from Lebanon to the Suez Canal. Israeli planners had grown up with the conflict surrounding the Middle East. They understood the equipment, organizations, and environment of the battlefield. The Israeli staff was also more familiar with the tools available for planning. This coupled with the Israeli holistic understanding of the planning staff, and a better situational understanding created a mismatch.

Officers in the U.S. Army conduct some kind of planning from the time they are commissioned. The tools they use for planning, however, constantly change. The introduction of CAPES into a staff is not as simple as changing from the reproduction of an operations order on a mimeograph machine to electronic distribution over the World Wide Web. CAPES is an

complex tool that requires extensive training. Part of this training is using the tool in a true planning environment. Often this experience can only be accumulated with on the job training. The forty hours of instruction students received prior to the exercise provided only a very basic familiarization with the system. Three things are required before a planner can effectively use CAPES as a planning tool. The first is an understanding of how to make things work. The CAPES training the students receive accomplished that. Students were able to move, fight, and synchronize forces to create a basic plan. The other requirements are not as simple to achieve.

In order for a staff officer to properly use CAPES they must understand why things occur. Planners must always question the system. Automated tools do not make decisions; they merely carry out the decision you make for them. Often the computer accepts orders based on a number of standard operating procedures or assumptions developed by the automation designers. The automation will carry out these procedures, even if the planner is not aware of them. Combat operations simulation modelers at the TRADOC Analysis Center (TRAC) are told when they arrive they will not likely assist the organization for a year. In fact, new modelers are typically a burden for that first year. The year is required to familiarize the new modeler with the system. After that year, they can begin to give back to the organization.¹¹² During that year however, they do not know everything about the model. They simply know to ask and how to go find out the answers to the questions. The CAPES system is not as complicated as the Vector in Command (VIC) model used at TRAC. An CAPES operator cannot however understand a new system in forty hours.

Finally, a staff officer cannot understand how to use CAPES properly, until he understands how the planning tool works within the military decision making process. FM 5-0, *Army Planning and Orders Production (DRAFT)*, discusses information systems and how they improve a commander's situational understanding. The document does not discuss how to

employ information systems or where the automated tools assist in the planning process. Doctrine remains vague enough to allow the individual staffs to determine how CAPES is best used. As new staff officers arrive at a new duty station, they must learn how that staff operates. This includes the use of automation tools. Many of the division and corps level staffs, units most likely to use CAPES, do not have procedures for its use in place. Students must either learn once they arrive at their new unit how to best use CAPES on a planning staff or the educational system must provide instruction on how to conduct MDMP with automation tools.

Collaboration

CAPES is designed to work as part of a systems of systems. CAPES is designed to exchange information with the Joint Common Database (JCDB).¹¹³ This database collects and stores information from all other ABCS Systems.¹¹⁴ It provides one method of information sharing between all the subsystems of ABCS. Unfortunately, information was not shared during the exercise. CAPES was the only automated command and control system used by the students. It had no connection to any other data source.

Because connectivity was not designed into the exercise the student planners did not have the situational awareness intended for its use. The predecessor of CAPES, the Battlefield Planning and Visualization (BPV) tool had more connectivity. BPV was able to gather friendly location data from Maneuver Control System (MCS). It also could draw locations of enemy forces from All Source Analysis System (ASAS).¹¹⁵ Students were only able to get similar information during the exercise after each game turn. Once CAPES received the data, it often required verification and correction to ensure proper strength levels. Using CAPES with out connectivity to other data processing systems degrades the value of the tool. Student planners

¹¹² John Abshire of Leavenworth, Kansas, interview by author, April 1999, Fort Leavenworth, Kansas, Initial job in brief at the TRADOC Analysis Center, Fort Leavenworth, Kansas.

¹¹³ Ibid., *CAPES: Reference Manual, Release 3.1*, 10-1

¹¹⁴ Ibid., *Army Battle Command System (ABCS) Version 6.2 Smart Book*, 20.

became frustrated because transferring data manually into the automated tool required more time and work to operate than historic non-automated tools. The students' limited training and lack of confidence of the system compounded their frustration.

Performing a truly accurate evaluation of CAPES requires two truly similar staffs. These staffs must do more than plan equivalent situations. They must possess similar doctrinal and military experiences. The staffs must receive the proper training for the tools they will use to plan. The tools must be complete and include the required linkages to operate properly and completely. Creating a staff possessing these characteristics, however, is expensive. Although attractive, the technique of creating planning staffs from students enrolled in the military school system has significant shortcomings. The student staffs neither have the required training on new planning tools nor the experience as an established planning team. More time and training are required in the curriculum if student staffs are used to test and evaluate evolving systems. Students need significant training in the new automation systems. This training must explain how the tool works and how it should be used in the military decision making process. Students also need time working together to develop the relationships found in developed functional staffs. Without the upfront commitment of these resources the test or evaluation will not provide the desired outcome.

The observations used for this study used resources already in place for the AMSP exercise. CAPES, like the study, was overlaid on an existing scenario. The original scenario's objectives were ill suited to evaluate CAPES. This created a number of problems in the evaluation. Eventually the problems created an environment that made assessment impossible. Reviewing the problem areas in this comparison will potentially prevent a repetition of these problems in the future. Money alone cannot solve all the issues discussed in this study. Nor will

¹¹⁵ Ibid., 14.

there be enough money to solve all of them. Future evaluators must first realize what problems may exist and then minimize them to the best of their ability.

ANNEX A

Global Command and Control System–Army (GCCS – A)

(GCCS-A) provides an integrated and automated Information Systems (INFOSYS) for Army strategic and theater commanders, corps commanders, and division commanders serving as joint task force commanders or Army service component commanders (ASCCs).

Mission Area:

GCCS-A is the Army component system that directly supports Army implementation of the joint GCCS. Its mission is to support monitoring, planning, and execution of joint, combined, and Army conventional military operations, as well as operations other than war for the Army Echelons Above Corps (EAC) and components of the Commanders in Chief (CinCs). GCCS-A ensures Army access to key information within the joint realm such as force tracking, host nation and civil affairs support, theater air defense, targeting, psychological operations, C2, logistics, and medical and personnel status. In turn, this information supports corps-level planning, execution, and monitoring of mobilization, deployment, sustainment, and redeployment of Army forces (ARFOR).

Location:

There is a GCCS-A system at both the corps main and tactical CPs.

Key Capabilities:

Commander's Force Analyzer:

The Commander's Force Analyzer provides current Time Phased Force Deployment Data (TPFDD). This information is key for planning the movement of forces and monitoring unit status and availability.

Logistics Analyzer:

The Logistics Analyzer in GCCS-A gives planners the capability to forecast the resources needed to support the force in various combat situations.

GCCS/GCCS-A Interface:

GCCS-A shares the client-server architecture Common Operating Environment (COE) with the joint GCCS for the general functions of teleconferencing, messaging, file transfers, office automation, utilities, and system administration (GCCS-A, however, uses a different commercial database system).

Maneuver Control System (MCS)

(MCS) is the primary tactical-level INFOSYS. It provides the common operation picture; decision aids, and overlay capabilities through interface with other ABCS systems.

Mission Area:

MCS is the ABCS system used by the operations staff to monitor the current battle and to plan the future battle. MCS gives commanders and staffs the ability to collect, coordinate, and act on near real-time battlefield information and to display the battlefield. MCS

integrates information horizontally and vertically to provide the Common Picture (CP) of friendly and enemy unit locations.

Location:

MCS is found at echelons from battalion through corps.

Key Capabilities:

Message Processor

The message processor is available on all MCS workstations. It is used to create, edit, transmit, print and store messages in both U.S. Message Text Format (USMTF) and Joint Variable Message Format (JVMF).

Operations Orders and Task Organization

With word processing templates and web browser technology, MCS can rapidly produce and distribute standard five-paragraph Operations Plans (OPLANs), operations orders (OPORDs), Fragmentary Orders (FRAGOs), and Warning Orders (WARNOs). Task organizations are created, edited, and displayed using the Unit Task Organization (UTO) Tool.

Collaborative Planning

MCS collaborative planning tools enable commanders and staffs to conduct multi-node collaborative planning sessions within or between CPs. These tools include data conferencing, chat, and whiteboard. The "John Madden"-style whiteboard is a powerful capability for wargaming, orders briefs, and backbriefs. The chat feature is similar to current chat programs available on personal computers. Multiple users can communicate simultaneously by posting text messages which can be read simultaneously by all chat participants.

Orders Products

Can produce orders, plans, and annexes. Used to develop task organizations, overlays, and synchronization matrices.

Analytical Tools

Can be used to develop and assess courses of action. Includes Distance/Rate Tool.

Reporting

Has messaging capability and report generator. Used to maintain the staff journal.

Key Information

Used to record/depict Named Areas of Interest (NAIs), Target Areas Of Interest (TAIs), Essential Elements of Friendly Information (EEFI), Commander's Critical Information Requirements (CCIR), Priority Intelligence Requirements (PIRs), High Value Targets (HVTs), and High Payoff Targets (HPTs).

Utilities

Can function as File Transfer Protocol (FTP) client/server. Possesses Adobe Acrobat, a file zip utility, MS Office, and a web browser.

Force XXI Battle Command Brigade and Below (FBCB2)

FBCB2 provides integrated, on-the-move, and timely relevant information (RI) to tactical combat, combat support (CS), and combat service support (CSS) leaders and soldiers.

Mission Area:

FBCB2 provides C2 and SU to the lowest tactical echelons. FBCB2 supports operational control chiefly through the transmission and receipt of orders, reports, and data via combat messages. FBCB2 employs a position navigation and reporting capability to depict and transmit the unit's own location. FBCB2 can also access other friendly units' locations as well as intelligence to show the friendly and enemy picture in near real-time and even while on the move. In its precursor version, FBCB2 is called "Applique."

Location:

FBCB2 is found throughout the battlefield from commander to platform and even soldier level.

Key Capabilities:

Situational Understanding

FBCB2 assists SU by telling the user his location as well as the location of other friendly forces, observed enemy forces, and reported battlefield obstacle locations. The user can adjust his picture of the battlefield by selecting which overlays, graphics, and icons are shown. Unit displays can be altered by grouping icons according to unit type or echelon.

Combat Messages

FBCB2 also automates frequently used urgent messages for reporting the enemy, requesting medical evacuation, NBC attack, call for fire, cease fire, and unit situation reporting. Enemy information can be rapidly formatted via an automated report. In turn, this information is forwarded to all other FBCB2 users as well as the ASAS system supporting the user, usually the task force or brigade S2. FBCB2 supports the call for fire process via a message in JVMF sent directly to AFATDS. The integration of the laser ranger finder with FBCB2's Ground Positioning System greatly improves the speed and accuracy of both calls for fire and enemy spot reports.

Logistical Reporting

FBCB2 provides key information input to CSSCS on unit logistical status.

Combat Service Support Control System (CSSCS)

CSSCS replaced by Battle Command Service Supply Support (BCS3) provides quality automated CSS information (including all classes of supply, field services, maintenance, medical, personnel, and movements) to combat, CS, and CSS commanders; their logistic and special staffs; and to the ASCC.

Mission Area:

CSSCS is the logistician's battlefield decision support and SU system for planning and controlling the logistics support of combat operations. Warfighters can logistically assess

future COAs using current or planned task organizations and approved planning factors. CSSCS can track the resource status throughout the task organization down to company level.

Location:

CSSCS terminals are found from the battalion through corps.

Key Capabilities:

Logistical Status Reports

Logistical reports show unit and resource status. This status is depicted with a color code of green, amber, red, or black using corresponding percentages set by the user. These reports can be displayed as web-based custom reports or as standard, pre-formatted reports. The standard report shows the logistical readiness of a unit and its subordinate units. The user can focus on parts of the report to isolate specific units and materiel items. This capability can help identify how an individual status affects the overall readiness rating of the unit. In the custom report, the CSSCS user can track the status of specific units and resources.

Capability Report

The Capability Report shows a unit's logistical ability to conduct sustained combat operations. This report provides unit resource status in relation to combat posture and intensity for the current day and next four days.

Supply Class Report

The Supply Class Report shows resource status with items grouped by class of supply.

Personnel Daily Summary

The CSSCS Personnel Daily Summary (PDS) depicts unit personnel status and is available for all company-size units and separate battalions.

Advanced Field Artillery Tactical Data System (AFATADS)

AFATADS is a fully integrated fire support INFOSYS. It gives the fire support coordinator automated support for planning, coordinating, controlling, and executing close support, counter, interdiction, and suppression-of enemy-air-defenses fires.

Mission Area:

Employed by artillery operations staff, AFATADS provides for fully automated fire support planning, coordination, and control of close support, counterfire, interdiction, suppression of enemy air defenses, and deep operations. AFATADS matches fire support weapons with targets based on target type, commander's guidance, unit availability, weapon status, and ammunition availability. It encompasses fire support platforms across the services, including mortars, field artillery cannons, rockets, close air support, attack helicopters, and naval gunfire. AFATADS is a multi-service system, being also employed by the United States Marine Corps.

Location:

AFATADS is positioned from the firing battery through EAC.

Key Capabilities:**Weapon-Target Pairing**

AFATDS analyzes a potential target and then identifies which available fire support systems would be most effective. This information is shown to the operator through a visual display.

Engagement Guidance

Based on the commander's guidance, the Target Management Matrix in AFATDS prioritizes targets and supported units, specifying the method of engagement and the volume of fire for each type of target. These priorities can vary according to varying guidance for each phase of an operation in order to best support the commander's intent and scheme of maneuver.

Fire Missions

AFATDS processes fire missions through combat messages in dialogue with MCS, CSSCS, AMDPCS, and FBCB2 and reports mission results to ASAS.

Fire Support Planning

In addition to managing the fire support of current operations, AFATDS assists fire support planning for future operations. Its planning mode offers decision aids and analytical tools to determine which fire support plan best supports a course of action.

Air and Missile Defense Planning and Control System (AMDPCS)

AMDPCS integrates air defense fire units, sensors and C2 centers into a single system capable of defeating/denying aerial threats (including unmanned aerial vehicles, helicopters, fixed-wing aircraft, and other platforms). AMDPCS includes AMDWS (the air and missile defense workstation).

Mission Area:

AMDPCS is the air defense staff's BAS that provides the commander with the tools required to monitor current air operation while planning for future events. It also provides SU of the third dimension. The Force Operations (FO) capability of AMDPCS supports the planning, coordination, preparation for, and sustainment of the air defense mission. It integrates air defense fire units, sensors, and C2 centers into a coherent system for defeating the aerial threat. Defense planning and analysis functions support the development of Air Defense Artillery (ADA) missions and the distribution and merging of missions between echelons. AMDPCS also supports Air Battle Management by displays which show Airspace Control Orders (ACOs), current fire unit status, alert posture, missile expenditure, and personnel ready for duty.

Location:

AMDPCS is located at the ADA battery CP with the maneuver brigade main CP, the division CPs, corps CPs, and at EAC.

Key Capabilities:**Air Defense Unit Status**

The unit status screen shows the location, alert status, onhand munitions, vehicles, and personnel for ADA units from section through battalion echelon.

Weapon and Sensor Visibility

AMDPCS also supports placement of ADA weapons and sensors. By analyzing platform capabilities and digitized terrain elevation data, AMDPCS can determine the area coverage of weapons and sensors at different locations.

Mission Planner

The AMDPCS mission planner shows zones of sensor coverage, weapons coverage, friendly and hostile air tracks, air avenues of approach, and airfields. The commander can use this display to synchronize air defense coverage with the planned scheme of maneuver. Operators can set parameters to depict aircraft at various altitudes based on the surrounding terrain.

Tactical Airspace Integration System (TAIS)

TAIS is the Army's enabling system for digitization, integration, and automation of Army airspace command and control planning and operations, and for air traffic services.

Mission Area:

TAIS is a digitized, integrated battlefield management and decision support system to assist the ground commander's role in the air battle. TAIS supports warfighters by automating Army Airspace Command and Control (A2C2) planning and operations and Air Traffic Services. TAIS also helps planners build Army input for the joint ACO to distribute the approved A2C2 overlay. TAIS can display Airspace Control Measures (ACMs) in two or three dimensions while monitoring the real-time airspace situation. TAIS provides SU of the third dimension by providing realtime airspace information that displays the location and movement of aircraft transiting the battlespace overlaid against current ACMs.

Location:

A TAIS system is found at the Division Main (command post) (DMAIN) to support A2C2 planning. A second TAIS will be located within the division area where it can optimally provide flight following functionality. At corps level, one TAIS will be found at the main CP while a second will be placed consistent with the tactical situation. TAIS is also found at EAC.

Key Capabilities:

Airspace Deconfliction

TAIS is able in real-time to deconflict (mathematically and graphically) airspace usage in the third and fourth dimensions (i.e., altitude and time). For example, the operator can graphically rotate a three-dimensional representation of the airspace to see ACMs from different angles, enabling him to see how they intersect and overlap.

Air Traffic Services

The Air Traffic Services display includes information from the ACO and Air Tasking Order (ATO). TAIS operators can use this display to track the flight of

aircraft. If an aircraft leaves the safe transition corridor, TAIS will alert the operator.

Communications

TAIS shall be able to communicate (voice and data) with current and future military aircraft (joint/combined), civilian aircraft and air traffic control systems, and other US and allied forces airspace users.

All Source Analysis System (ASAS)

ASAS consists of evolutionary modules that perform system operations management, system security, collection management, intelligence processing and reporting, high-value/high-payoff target processing and nominations, and communications processing and interfacing.

Mission Area:

ASAS is the ABCS intelligence fusion system used by intelligence staff. ASAS receives and processes large amounts of intelligence and information from sensors, processors, and communications systems at national, theater, and tactical echelons to include spot reports from FBCB2. It provides a timely, accurate, and relevant picture of the enemy situation. The intelligence officer can use his ASAS Remote Workstation (RWS) for automated situation development, COAs, targeting, tactical warning, and Battle Damage Assessment (BDA).

Location:

ASAS can be found at echelons from battalion to corps. An ASAS RWS can function as a stand-alone system or as an adjunct to an Analysis and Control Element (ACE) at corps and division level and the Analysis and Control Team (ACT) at brigade.

Key Capabilities:

Intelligence Preparation of the Battlefield (IPB)

Intelligence personnel can use the analysis tools in the ASAS RWS for their IPB. For example, it is able to depict tracked vehicle GO and NO GO areas overlaid on a terrain map.

COA Analysis

The ASAS RWS assists the warfighter's COA analysis with information on enemy units, equipment, locations, and movements.

Targeting and Alerts

Using reports and sensor inputs, the RWS can alert the operator to enemy targets and can automatically nominate them for friendly supporting fires. Commanders and staff can even focus ASAS on the specific types of targets that will best support the mission.

Enemy Situation Monitoring

ASAS also monitors the current enemy situation. Using the latest combat information and intelligence, it maintains and displays timely, detailed data on enemy units.

Intelligence, Surveillance, and Reconnaissance (ISR)

Provides ISR management and analytic support to the battalion intelligence officer for SU, tactical warning, force protection, and targeting.

Nexus for Battalion-Level ISR Operations

Processes input data from battalion ISR systems and sources. Provides analyzed red picture to the operational picture.

Integrated Meteorological System (IMETS)

IMETS provides general weather forecasting, severe weather warnings, and weather effects analysis.

Mission Area:

IMETS is the meteorological component of ABCS. It gives intelligence staffs and commanders an automated, high resolution weather system to receive, process, and disseminate current weather observations, forecasts, and weather and environmental effects decision aids.

Location:

IMETS workstations manned by staff weather teams can be found at the aviation brigade main CP and the division and corps main CPs.

Key Capabilities:

Weather Data Integration

IMETS receives weather information from polar-orbiting civilian and military meteorological satellites, the Air Force Global Weather Center, artillery meteorological teams, remote sensors, and civilian forecast centers.

Weather Products

IMETS processes and collates forecasts, observations, and climatological data to produce timely and accurate weather products tailored to the warfighter's specific needs.

Web Page

Additional weather information is available via the IMETS web pages.

Weather Warnings

Severe weather warnings are disseminated to units via USMTF message.

IWEDA

The Integrated Weather Effects Decision Aid (IWEDA) displays weather effects on weapon systems or missions. The IWEDA client is available to all BASs. For example, it can show the various weather effects, whether favorable, marginal, or unfavorable on various weapons over the next twenty-four hours.

Digital Topographic Support System (DTSS)

DTSS provides tactical and operational commanders with geospatial information to support terrain and environment parts of commander's visualization.

Mission Area:

DTSS enables topographic support personnel to receive, format/reformat, store, retrieve, create, update and manipulate digital topographic data. DTSS gives the warfighter digital terrain analysis, terrain databases, updated terrain products, and hard copy reproduction of topographic products to include maps. Its tactical decision aids support COA analysis and the decisionmaking process. These aids include mobility analysis, intervisibility analysis for determining line of sight, environmental and climatology analysis, terrain elevation, and other special products. Using the Global Broadcast Service (GBS), DTSS receives and distributes digital terrain data from the National Imagery and Mapping Agency (NIMA). DTSS can update existing digital maps from satellite imagery and produce full size, color paper maps from any DTSS product.

Location:

DTSS is found at the corps main CP, DMAIN and tactical CPs, and brigade CPs.

Key Capabilities:

Mobility Analysis

DTSS is able to produce sophisticated mobility analysis products. For example, it can provide a detailed analysis comparing off-road mobility of the High Mobility Multipurpose Wheeled Vehicle (HMMWV) and the Abrams Tank.

Intervisibility Analysis

DTSS can perform intervisibility analysis, which is overlaid on a terrain map backdrop. For example, from any point on the map, it can depict every other point within line of sight of that first point.

Three-Dimensional View

DTSS can also depict a three-dimensional view such as a "fly-through" area. Colored areas show threat and friendly air defense domes superimposed on satellite imagery. The DTSS database contains detailed terrain information, but not weapon characteristics and locations; these must be obtained from the intelligence staff.

Integrated System Control (ISYSCON)

ISYSCON provides integrated technical system control for the integrated ABCS systems.

BIBLIOGRAPHY

- Abshire, John, Chief Wargaming and Simulations, TRADOC Analysis Center, Fort Leavenworth, Kansas. Interview by author, April 1999, Fort Leavenworth, Kansas. TRADOC Analysis Center, Fort Leavenworth, Kansas.
- Adan, Avraham. *On the Banks of the Suez: An Israeli General's Personal Account of the Yom Kippur War*. San Francisco: Presidio Press, 1980.
- Aker, Frank. *October 1973: The Arab-Israeli War*. Hamden, Connecticut: Archon Books, 1985.
- Allen, Charles B. "4th ID DCX II: The Digitized Division Fights the COE OPFOR." *Field Artillery* March – April 2002: 19-22.
- Allen, Peter. *The Yom Kippur War*. New York: Scribner's Sons, 1982.
- The American Heritage® Dictionary*, 4th ed., s.v. "beta test". Houghton Mifflin Company. Internet: <http://dictionary.reference.com/search?q=beta%20test>. Accessed 31 March 2004.
- , s.v. "information age". Houghton Mifflin Company. Internet: <http://dictionary.reference.com/search?q=information%20age>. Accessed 31 March 2004.
- "Arab-Israeli Wars History Text." Internet: <http://www.palestinehistory.com/wartext.htm>. Accessed: 3 February 2004.
- "The Balfour Declaration." Internet: <http://www.mfa.gov.il/mfa/go.asp?MFAH00pp0>. Accessed 3 February 2004.
- Benson, Kevin C. M. *Decision Making in the Information Age: A Case for Updating the military Decision Making Process*. Carlisle Barracks, Pennsylvania: U.S. Army War College, 2002.
- Brecher, Michael. *Decisions in Crisis: Israel, 1967 and 1973*. Los Angeles, California: University of California Press, 1980.
- Brooks, John R. and Steven L. Campbell. "The EXFOR, Intelligence in Force XXI." *Military Intelligence Professional Bulletin*, 1996, Internet: <http://www.fas.org/irp/agency/army/tradoc/usaic/mipb/1996-2/brks-cam/htm>. Accessed 27 January 2003
- Burt, John D. "Organized Chaos: Israeli Defense Doctrine and Tactics." *Strategy and Tactics*, May 1994, 12-21.
- Chau, Ka-Ki. "Providing Command and Control Tools to the Warfighter and Homeland Security Applications." CERDEC, C2D. Fort Monmouth, NJ. Presented to 2004 Command and Control Research and Technology Symposium. Internet: http://www.dodccrp.org/events/2004/CCRTS_San_Diego/abstracts/226.pdf. Accessed 24 March 2004.
- "Cold War Timeline." Internet: www.fas.org/man/dod-101/ops/docs/coldwar_timeline.htm. Accessed 27 January 2004.
- Cordesman, Anthony H. and Abraham R. Wagner, *The Lessons of Modern War, Volume I: The Arab-Israeli Conflicts 1973 – 1989*. Boulder, Colorado: Westview Press, 1990.

- Dawidowicz, Edward. "The Right Information... and Intelligent Nodes." Presented to 8th International Command and Control Research and Technology Symposium. Internet: <http://philsci-archive.pitt.edu/archive/00001282/01/105.pdf>. Accessed 15 April 2004.
- Department of the Army. *ABCS: Army Battle Command System Leader's Reference Guide. Version 6.2*. Washington D.C.: U.S. Government Printing Office, 12 February 2002.
- , *Army Battle Command System (ABCS) Version 6.2 Smart Book*, Fort Hood, TX. Created locally by Warrior-T for DCX Phase I. January 2001.
- , *CAPEX: The Combined Arms Planning and Execution Monitoring System. Reference Manual, Release 3.1*. Washington D.C.: U.S. Government Printing Office, July 2003.
- , *FM 1, The Army*. Washington D.C.: U.S. Government Printing Office, 14 June 2001.
- , *FM 3-0, Operations*. Washington D.C.: U.S. Government Printing Office, 14 June 2001.
- , *FM 5-0, Army Planning and Orders Production. Final Draft.* Washington D.C.: U.S. Government Printing Office, 15 July 2002.
- , *FM 6-0, Mission Command: Command and Control of Army Forces*. Washington D.C.: U.S. Government Printing Office, 11 August July 2003.
- , *FM 101-5, Staff Organization and Operations*. Washington D.C.: U.S. Government Printing Office, 31 May 1997.
- , *TRADOC Pamphlet 525-3-0.1. The United States Army Objective Force Battle Command (C4ISR) Concept, Staff Organization and Operations. Final Draft*. Washington D.C.: U.S. Government Printing Office, 4 March 2003.
- , *TRADOC Pamphlet 525-5. FORCE XXI OPERATIONS: A Concept for the Evolution of Full-Dimensional Operations for the Strategic Army of the Early Twenty-First Century*. Washington D.C.: U.S. Government Printing Office, 1 August 1994.
- , *Weapon systems 2001*, Washington D.C.: U.S. Government Printing Office, 2001. Internet: <http://www.defensedaily.com/progprof/army/abcs.pdf>. Accessed 9 April 2004
- Dupuy, Trevor N. *Elusive Victory: The Arab-Israeli Wars, 1947-1974*. Fairfax, VA: Hero Books, 1984.
- "The End of the Cold War." Internet: <http://americanhistory.si.edu/subs/history/timeline/end/index.html>. Accessed 27 January 2004.
- "Facts About Israel: History." Internet: <http://www.mfa.gov.il/mfa/go.asp?MFAH00kt0>. Accessed 3 February 2004.
- Frame John E. "Intelligence Planning in the Digital Division." *Military Intelligence* 24(2). April-June 1998. Internet: <http://www.fas.org/irp/agency/army/tradoc/usaic/mipb/1998-2/FRAMEb.htm>. Accessed 15 April 2003.
- Gawrych, George W. *Leavenworth Papers. Number 21, The 1973 Arab-Israeli War: The Albatross of Decisive Victory*. Washington D.C.: U.S. Army Center of Military History, 1996.
- Griess, Thomas E. *The West Point Military History Series: Atlas of The Arab-Israeli Wars, The Chinese Civil War, and the Korean War*, Wayne, New Jersey: Avery Publishing Group Inc., 1987.

- , *The West Point Military History Series: The Arab-Israeli Wars, The Chinese Civil War, and the Korean War*, Wayne, New Jersey: Avery Publishing Group Inc., 1986.
- Horowitz, Daniel and Edward N. Luttwak. *The Israeli Army, 1948-1973*. Lanham, Maryland: University Press of America, 1975.
- Herzog, Chaim. *The Arab-Israeli Wars: War and Peace in the Middle East*. New York: First Vintage Books, 1982.
- “The History of the Golan.” Internet:
http://www.unitedjerusalem.com/THE_GOLAN/the_golan.asp. Accessed 3 February 2004.
- “History of Israel & ‘Palestine’.” Internet: <http://www.masada2000.org/historical.html>.
 Accessed 3 February 2004.
- “Israel Science and Technology Homepage: Brief History of Israel and the Jewish People.”
 Internet: <http://www.science.co.il/Israel-history.asp>. Accessed 3 February 2004.
- “Israel Wars & Maps.” Internet:
http://www.unitedjerusalem.com/HISTORICAL_PERSPECTIVES/Israel_Wars_Maps___History.asp. Accessed 3 February 2004.
- Kahalani, Avigdor. *The Heights of Courage: A Tank Leader's War on the Golan*. Westport, Connecticut: Greenwood Press, 1984.
- Klein, Gary. *Sources of Power: How People Make Decisions*. Cambridge, Massachusetts: MIT Press, 1999.
- LaChance, Michael A. “The Digital Planning Process: Lessons Learned from the AWEs.” *Military Intelligence* 24(2): April-June 1998. Internet:
<http://www.fas.org/irp/agency/army/tradoc/usaic/mipb/1998-2/LANCHANCEb.htm>.
 Accessed 10 September 2003.
- Mayfield, Thomas D. *Parallel Planning: How Digital Information Systems Can Improve the Combat Decision-Making Process*. SAMS Monograph, U.S. Army Command and General Staff College, 1996.
- McKenna, Ed. “Agency Profile: Army: Army Modernizes as It Digitizes.” *Washington Technology*. Internet:
http://www.washingtontechnology.com/news/15_6/tech_features/1474-1.html. Accessed 1 April 2004.
- Moore, Perry. “OPERATION SHOCK TROOP: The Drive on Damascus, October 1973,” *Strategy and Tactics*, May 1994, 4-11.
- Oren, Michael P. *Six Days of War: June 1967 and the Making of the Modern Middle East*. New York: Oxford University Press, 2002.
- “Peace with the Golan: Water Issues of the Golan Heights.” Internet:
<http://www.golan.org.il/water.html>. Accessed 7 February 2004.
- Rauhut, Michael. “Put Me in, Coach!” *Army Magazine* June 2002: Internet:
<http://www.ausa.org/www/armymag.nsf>. Accessed 26 January 2004.
- Sevcik, Michael C. *Force XXI Technology and The Cognitive Approach to The Military Decision Making Process (MDMP)*. SAMS Monograph, U.S. Army Command and General Staff College, 2000.
- Shazly, Saad el. *The Crossing of the Suez*. San Francisco: American Mideast Research. 1980.

- Steele, Dennis. *The Army Magazine Hooah Guide to Army Digitization*. The Association of the U.S. Army, 2001.
- Tiboni, Frank. "Army plans spring deployment of ABCS." *Federal Computer Week*, Internet: <http://www.fcw.com/fcw/articles/2003/1222/web-abcs-12-24-03.asp>. Accessed 25 April 2004.
- Toomey, Christopher J. "Army Digitization: Making it Ready for Prime Time." *Parameters* Winter 2003 – 04: (40-53).
- Turabian, Kate L. *A Manual for Writers of Term Papers, Theses, and Dissertations*. 6th ed. Chicago: University of Chicago Press, 1996.
- Walczyk, Thomas. "October War: Doctrine and Tactics in the Yom Kippur Conflict 6-24 October 1973," *Strategy and Tactics*, March 1977, 4-18.